AMERICAN MACHINIST

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Vertical Chucking Machine—Plain Milling Machine.

We illustrate on this page a vertical chucking machine, designed for doing rapid work in shops where considerable work of the kind is done. It also does the work in a superior manner. The different tools in the turret head are easily brought into operation in succession, while from the perpendicular position of the same, the chips fall through the center of spindle of revolving table to the floor, causing no trouble by clogging of reamers, etc.

It has the capacity to take a pulley 36 inches diameter, 18-inch face, and hub of 12 inches in length, and to bore a 4-inch hole in same, making two or three cuts, and finish by reaming, without removing the tools or work.

The revolving table is driven by a 5-step cone for a 3-inch belt, and geared 6 to 1; steps of cone so graded as to make cutting speed uniform for 5 different diameters of holes.

The turret has four holes $1\frac{3}{4}$ inch in diameter, and is securely clamped in position. An adjustable dog allows the locking pin to be withdrawn at any part of its upward motion.

The turret slide has a movement of 21 inches, and an automatic feed which can be easily and quickly changed from the finest ever needed to the coarsest required, it has quick return by hand, and is counterbalanced by a weight inside of column. The weight of machine is 4,400 pounds.

The plain milling machine, shown on page 2, is known in the series as the "No. 3" machine. The spindle is driven by a gear and pinion from a 3-step cone with 3-inch belt. It has a vertical adjustment of 6 inches. The table is 9 inches wide, 27 inches long, and has 12-inch longitudinal and $4\frac{1}{2}$-inch transverse movement, and is moved longitudinally 2 inches by one turn of the hand-wheel. The feed is automatic with three changes, stopping automatically at any required point. The vise has jaws $6\frac{1}{8}$ inches long, $1\frac{7}{16}$ inch deep, and will open $3\frac{3}{8}$ inches. Countershaft has pulleys 10 inches diameter, for 3-inch belt, and should run about 375 turns per minute. Weight of machine 2,550 pounds.

The manufacturers of these machines are the Brown & Sharpe Manufacturing Co., Providence, R. I.

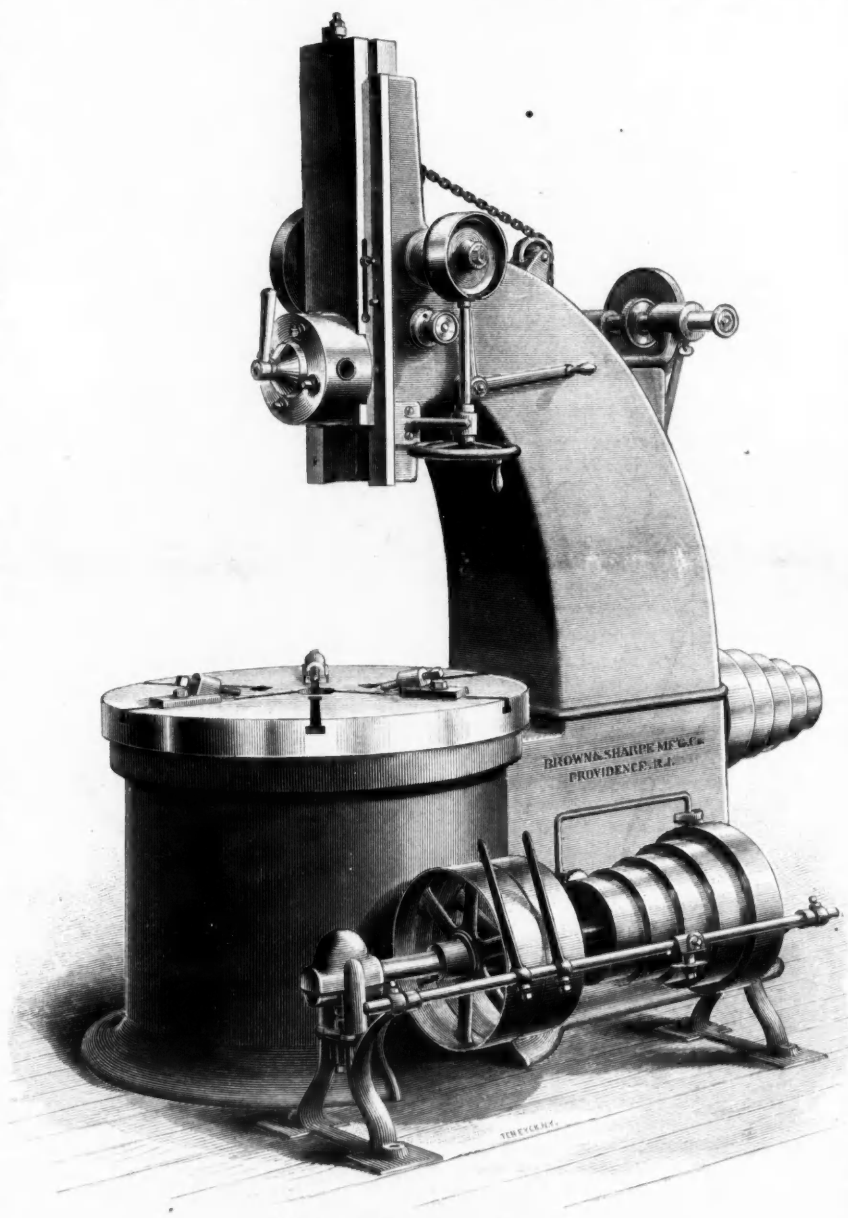
In a fusible plug for boilers, in use in England, asbestos packing is introduced between the water in the boiler and the fusible metal; this, it is claimed, prevents deleterious action of the water on the metal, and also in case of low water prevents contact of the steam preventing complete melting of the plug.

An engineer, of San Jose, Mexico, would like to hear from some one having experience of a good way of tempering miners' drills for hard rock. He says he has tried sharpening by hammering to an edge, and also by filing them after they were dressed, and then tempering in water, but finds trouble in getting them to stand.

Bronze and Brass Castings, and Brass in the Cupola.

BY ROBERT E. MASTERS.

Phosphor-bronze is so much superior to ordinary bronze, where strength or resistance to friction is required, that it is desirable that every firm have a brass furnace to make castings of the first-named metal.



VERTICAL CHUCKING MACHINE.

One objection in the past to making phosphor-bronze castings has been that the pigs or ingots were prepared with a certain percentage of phosphor and tin to suit different classes of work, and to meet all the requirements of the trade, a firm had to keep in stock a large number of ingots of different alloys of phosphor-bronze. This was an expense which the smaller foundries throughout the country did not feel justified incurring. Since the alloy known as "phosphor-tin" has been placed on the market, it is no trouble for foundrymen to supply their customers with phosphor-bronze castings of any degree of hardness.

In making castings where phosphor-tin is employed, care should be taken to avoid the use of zinc, or any mixtures containing zinc. I once saw a piston-ring, which was made of 40 pounds old brass turnings, 55 pounds old copper, with 5 pounds phosphor-tin in the mixture. The ring, after it had been finished up, was accidentally dropped on the plank floor in the machine shop, and it was so brittle that it broke into several pieces; this was owing to the poor quality of the old brass, and the zinc it contained.

Good brass and old copper can be used to advantage, although those using old copper will find there is a larger percentage of loss by waste than in using new copper.

Moulds made for phosphor-bronze castings ought to be skin-dried, as this prevents the tin from cutting into the sand and making such a "scabby," rough casting, as it usually does when poured into green sand.

Phosphor-tin, when struck with a hammer, breaks in irregular shapes, presenting about the same leaf-like foliage appearance that antimony does, and but for its yellowish tinge could be easily mistaken for that metal by a person not well acquainted with them. Besides the mixtures given in my last article, I will add: Pinions I have made of 82 pounds copper and 18 pounds phosphor-tin have worn well, and withstood sudden jars and shocks, where pinions made of ordinary bronze did not give good satisfaction.

While I am on this subject of bronze and brass castings, I will mention a few items that may be useful to those who occasionally make this class of work. A gentleman once complained to me about some brass tubes that he had cast in his foundry, only a small percentage of them answering the purpose for which they were intended. The next time he had occasion to make some, he invited me down. The castings were 2″ in diameter, 12″ long, with a flange $\frac{1}{2}$″x$\frac{1}{2}$″ on one end, having a hole 1″ in diameter cored through them.

These castings had been moulded and poured in a horizontal position; after they were bored out and finished up outside they would leak when the steam pressure (60 lbs. of which they had to stand), was put on. They had two patterns to make these castings from, and I found that there was plenty of room to lay a sprue in a horizontal position between them. We cut a hole in the side of the flask, at the joint, large enough to admit the sprue. We put up a few moulds, gated them in the flange, set the cores and closed the moulds, then put an ordinary bottom-board on top of the cope. After clamping them securely, we stood the flasks on their ends, flange end of the moulds being down. After the crucible had been lifted out of the furnace and skimmed off, we dropped a piece of lead weighing 2 pounds into 100 pounds of brass, and stirred it up thoroughly. There was considerable dross came to the top, which was skimmed off, and the moulds poured immediately. The tubes which were poured in this manner were found upon testing, to be perfectly sound. A very small percentage of lead, used as described, makes the brass flow freely and settle solid.

A friend of mine, who makes a great many brass hammers for marking saw-logs, told me at one time he had some marking-hammers to make, and wanted to melt 100 pounds of brass; on weighing up his metal he found he only had 90 pounds on hand; to this he added 10 pounds of cast iron, not knowing what the result would be. The marking-hammers he made from this mixture were as hard as steel, and gave better service than any he ever made.

I had a little experience of my own once, in a mixture of brass and iron, which was not so satisfactory as the above. I was foreman in a foundry making a great many locomotive and car castings. We received in return from the railroad company cast-iron scrap, in part payment for the work. Among this scrap would be a great many car-wheels and journal-boxes; these were always covered with grease and dirt. We would stack the wheels up in rows, filling in between and on top with shavings and wood; on top of this we piled the journal-boxes. We then set fire to the shavings and burned the grease all off, leaving the scrap clean and in good condition for the cupola. One of the chief objects in doing this was to get rid of the little particles of brass which would wear off from friction of the journal on the brass in the journal-box, and settle among the grease and dirt.

One time the grease on some of the boxes was not thoroughly burned off. These were put in the cupola as scrap in the last two charges of a heat. As soon as they began to melt, the same kind of smoke that issues from a brass furnace on adding zinc to a ladle of melted copper, came from the

stream of iron as it flowed down the cupola spout in such volumes that we could scarcely see the cupola. After the heat was over, the whole inside of the cupola, and on the outside above the spout and charging-door, was covered with a zinc-like coat, and all of the castings that were made from those two charges of iron were as hard as flint. I attributed this to the zinc in the particles of brass that were in the grease in the journal-boxes, and was always very careful afterwards to have pieces that were not thoroughly burned off laid under the cupola, so that when the bottom was knocked out the cinders would fall on them. I have used mine car-wheels for scrap that were covered with grease without burning off, and there would be no noticeable effect in the castings produced; but these wheels had no brass about their journals.

It is pretty thoroughly understood among moulders that fluid iron has no affinity for zinc. This was forcibly impressed on my mind in the early days of my apprenticeship, when I scarcely knew what zinc was. I often had to carry a hand-ladle of iron to feed up a riser. One day I made a fender out of sheet zinc, and put it between the shank and ladle, to keep the heat off my hand. As soon as the heat of the iron began to have its effect on the zinc, it wilted down into the fluid metal, and—bang!—the hand-ladle was cleaned out in an instant, and the iron flew all over the shop.

More About Jigs.

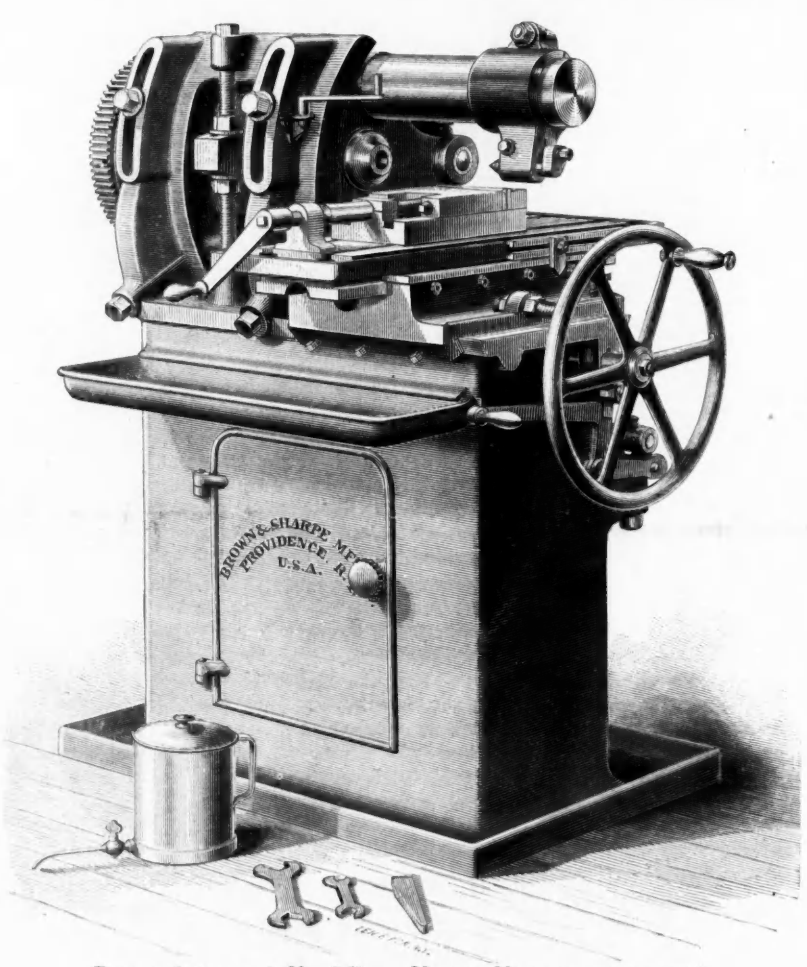
BY S. W. GOODYEAR

In your issue of September 26, Wm. T. Silver, in referring to what he calls my "account of using jigs," charges me with being silent just where he wanted me to talk, and indicates what seems to him to be lacking by this question: "How is the best way, with ordinary tools, to drill holes in jigs *exactly* where you want them? By this I mean so exact that if a jig is turned over or reversed on another one, close-fitting plugs will slide through the holes of both."

Does he mean "turned over or reversed?" But few of the many jigs in use, in which there are several holes, would be properly tested in that way, as by it the relation of the holes would be entirely changed. To apply the test proposed, the jigs should be kept the same side up, and same side first. To answer his question, according to the qualification he gives, would be in some degree furnishing evidence that no jigs are needed. To explain: The use of the jig being to locate holes, having *one* made, *it* should be used to locate the hole in a second one if wanted, and, if properly used, there should be no difficulty in finding that "close-fitting plugs will slide through the holes of both." In my letter on jigs, which appeared in the AMERICAN MACHINIST of September 5, I used this language: "One jig being made, let us make it act as a jig for forcing the other to be in the most essential parts an exact duplicate; that is, if we don't belong to the class of workmen who are so sure that they can measure, and lay out and drill within a millionth part of an inch."

As drilling jigs were under consideration, of course "most essential" referred to drilling, and I gave my plan. Mr. Silver seems to want a plan whereby the two can be made separately, and independently of each other, but be *exactly* alike. This implies a nicety which is seldom called for in the initial jig, as in most cases there is some margin, some limit of deviation within which the jig will be all right, but when once made it will be expected to perform the duty for which it was designed—that is, to aid in reproducing in all work drilled by it the *exact* location of holes which it represents itself.

Is this dodging? Why don't I come out squarely and answer the question? Well, because I am not at all certain that the entire space allotted to practical men by the AMERICAN MACHINIST would suffice, in a whole year, to give any more than a fraction of the ways and means for locating holes in jigs. Does the proprietor, or superintendent, or foreman in a machine shop put his men through an examination to learn in advance how they would do certain jobs if they had them to do? Tom, Dick and Harry, and even Jim and Tim, would say, "Bring on your job; when we see it, we will make up our minds how is the best way." Who that has bossed a machine shop cannot look back upon men who were always telling how they would do everything, whether they were asked or not, and who never did anything the best way, while other men, who would never tell anything about what they would do beforehand, rarely failed to find a good way—many times the very best way—as each new job was put in their hands? Will somebody, in what they consider the higher walks in life, laugh at us, if we say that there is an inspiration in the very presence of the job to be done, which is as necessary to bring out the best thoughts of the mechanic as are the contemplation of the wonders and beauties of nature and art to aid the poet, the orator, the artist, in their greatest efforts? Who among us has not experienced a thrill of satisfaction, and found himself thoroughly surprised, at the effectiveness of some plan for expediting or perfecting some difficult piece of work, a method of which the books give him no hint, nor in all of his years of



BROWN & SHARPE'S NO. 3 PLAIN MILLING MACHINE.—See page 1.

practice and labors with thousands of other men, has he, to his recollection, seen anything like it; but, like a flash, it comes to him that here is a way? He tries it; it is just the thing, and, as his shopmates look on admiringly, each wonders why it was not thought of before, and says, "Why didn't I think of it? So simple!"

To lay out for drilling, through the agency of scale, straight-edge, try-square, scratch-awl, prick-punch and dividers, is the best way on one account—it is the way with which everybody is familiar; and, when some men locate a hole in this way, it is sure to be *pretty near* right, but there is a "right smart difference" in men, and "a heap" of room for variation, and, even when there is the utmost care, with the scribing the most accurate and lines of the finest, it is not only difficult to drill *exactly*, but difficult, after the drilling is done, to tell by the lines whether it has been done *exactly*.

To crowd the drill this way or that, or change its inclination to one side of the hole or the other, by cutting a channel with a chisel on the side to which the drill is required to run, is very easy; but when to stop, whether the space between inscribing line and drilling is of *exactly* equal width on all sides before the drill has cut to its full size—this is the nice point; and how often it will seem as though the drilling was *exactly* concentric with the scribing up to the last instant before the full width of lip begins cutting, when the entire disappearance of the scribing on one side of the hole, with the entire line and some space left on the other side, as the full size of the hole is reached, shows the operator that he has been the victim of an optical illusion. Why not? for the chances are that he had to make all of his observations from one side of the hole, or that to see it at all he had to stand in some cramped position to get out of his own light.

Ought not the subject itself to suggest a way? Jigs for drilling imply that drills are to be guided to the *exact* place where holes are wanted, by running through guiding holes which fit the drills. Why, then, should we not be guided, in selecting a plan, to adopt that which comes the nearest possible to the action of a jig? Two parallel pieces, fastened in the right position, and just the right distance apart for the drill to run between them, will locate the hole one way. Two strips of metal fastened between these pieces in the right position to locate the hole the other way, and an improvised jig is had. A square hole through which to guide the drill would not be advisable for constant use, but there are many cases in which the principle indicated here, under such modifications as the particular case in hand requires, would beat drilling to a line out of sight. A piece of steel or iron can be easily strapped, or clamped on by measurement, just half the diameter of the hole from the center, and thus settle the matter of the drill running out in that direction.

Suppose several holes are required to be exactly parallel with each other, and on a line exactly a certain distance from measurable points on the piece to receive the holes, and, further, that the holes shall be equidistant from each other. Who believes that laying out and drilling will accomplish this?

If some well-digested plan, with machinery to match, like a drill-carrying, sliding spindle, in which the drill passes through a fixed guide preventing all spring, the guide reaching as near to the face of the piece to be drilled as possible, which piece is attached to a table, or slide that can be moved in a right line, and, through an indexed dividing device, can be move exactly the right distance for each succeeding hole, is to be used, there is little to say; and doubtless there will be, on the part of those who have all the modern appliances, a disposition to sneer at us, who must get along with the common tools, when we begin by drilling two holes exactly the right distance apart through a piece of steel. Of course, these holes are to fix the drill to be used, and they must be exactly equidistant from one edge of the piece. If they were not drilled so, some judicious cut-and-try work with a file, or a chip taken off by planer or shaper, with the piece supported by a stud or bit of wire from each hole, will fix that all rights and now, with a parallel piece fastened on to the surface to be drilled, just as far back from the line on which the holes are wanted, as from this trued-up edge of our jig (?) to the center of the holes, we are ready for operation. Clamping our two-hole jig against the parallel piece, so that the first hole will be in right position longitudinally in the line the hole is drilled, a stud exactly fitting the hole is now put in, and the drill, passing through the other hole in the jig, drills the second hole in the line. Now there is nothing to do but, by moving the jig forward a hole successively, and fixing it in position with stud and clamp, drill the holes just right; and, whether it be three or thirty which constitute the row of holes that must be in an *exact* line, and the distance between each two consecutive holes *exactly* alike, who don't know that the plan will "knock the spots off" the closest laying out and drilling?

"But," says some objector, "how can any closer measurements be made for locating the guides than can be made for laying out? Shall we not work, after all, to scribing; and can we set the guiding pieces any nearer to a line than we can drill to it without the guides?" Actual measurements should be made to accomplish what no amount of squinting and guessing at prick-punch marks and scribings will ever more than approximate, except by accident. Not the kind of measurement that spaces off distances from rule, or steel scale with dividers, and with their points transfers the marking to the work, but that kind of measurement which involves the use of vernier or micrometer devices by which the thousandth part of an inch, or its fractions, can be measured. How are they to be used? That is just the question. Starting from a fixed point, draft into service something, anything, which can be measured and made to space off the distance to the piece which you wish to fasten in position. But, how to find anything the right size or length? Well, if there are any ring and plug gauges in the shop—if there are not there should be—they will go a great ways in making up what is needed. The odds and ends about planers and lathes and on the bench will come in play, and from the assortment of drill rods which most shops keep now-a-days and all should keep, can be got a most admirable variation of sizes, while these may be pieced out with bits of sheet metal or paper, and possibly the new micrometer adjusting inside caliper, recently illustrated in the AMERICAN MACHINIST, may be at hand; if so, it will soon prove to be, like other measuring instruments which gain their value from the micrometer adjusting device, "worth its weight in gold."

It may seem to some a frivolous waste of time when a piece needs to be moved some *exact* distance, or needs to be placed and fastened some *exact* distance from some other piece or projection, to hunt up a piece, or pieces, which together, make up the measurement and place between. Suppose a piece which is clamped in place needs moving an exact inch. Who is ready to say that a line can be made in just the right place, and the piece moved *exactly* to the line? Who will dispute the statement that placing a standard inch plug gauge against the piece to be moved, and clamping down another piece, so that the inch plug will just fit between the two, that by removing the plug, releasing the piece to be moved from its fastening, and sliding it forward until it touches the last piece to be clamped down, it will have moved an *exact* inch? If an inch, why not any other distance? If the

piece can be moved so *exactly*, why not place any piece just as exactly, in the same way? "Too much fussing," does somebody say? Well, it may look so to those who have not tried it, but to the writer, who has over and over, for more than thirty years, wasted time (?) in this way, to the entire satisfaction of his employers and himself, it doesn't seem frivolous. Methods by which needed results *must* come, should be adopted whenever possible. Who among the drilling fraternity will not be ready to own that drilling holes between two pieces of metal, so that *exactly* half the hole shall be in each piece, is difficult? Suppose, however, a perpendicular wall rising above each piece at exactly half the diameter of the drill, back from the meeting faces of the two, running between these, how can the drill get out of the center?

And still I have not answered Mr. Silver's question. I did not propose to. How should I know the *best* way? I have simply tried in this, as in the letter to which he referred, to set somebody thinking. Those who know more about the matter, and whose "ways" are bettter than mine, don't need to laugh, if the statement of a correspondent is true, "that probably not one in a dozen of mechanics in general knows anything about the construction and use of jigs."

Observations in a Machine Shop.

BY TANGENT.

FOURTH PAPER.

MY SECOND ROW WITH SAM CARSON.

While Sam and I were talking, there came up a young fellow; I think he was about the dirtiest specimen I ever saw. He had no overalls on, and only one suspender; he had in a quid of tobacco, which he was rolling over his front teeth. I stood facing him as he came up the shop; Sam's back was toward him. I saw the wink he gave the boy at the drill press as he passed. He had a freshly cut gear-wheel in his hand. He came up to Sam and said very blandly, "Mr. Carson I am very sorry, but I have broken this wheel." Sure enough, there it was cracked clean through the hub. Sam got red in the face; he knew what that wheel had cost, he knew that it was promised that afternoon. I have no doubt that a vision of Bruiser danced through his mind, and blended with sixteen square inches of tobacco-smeared jowls of the guileless and innocent visage that looked so confidingly to him.

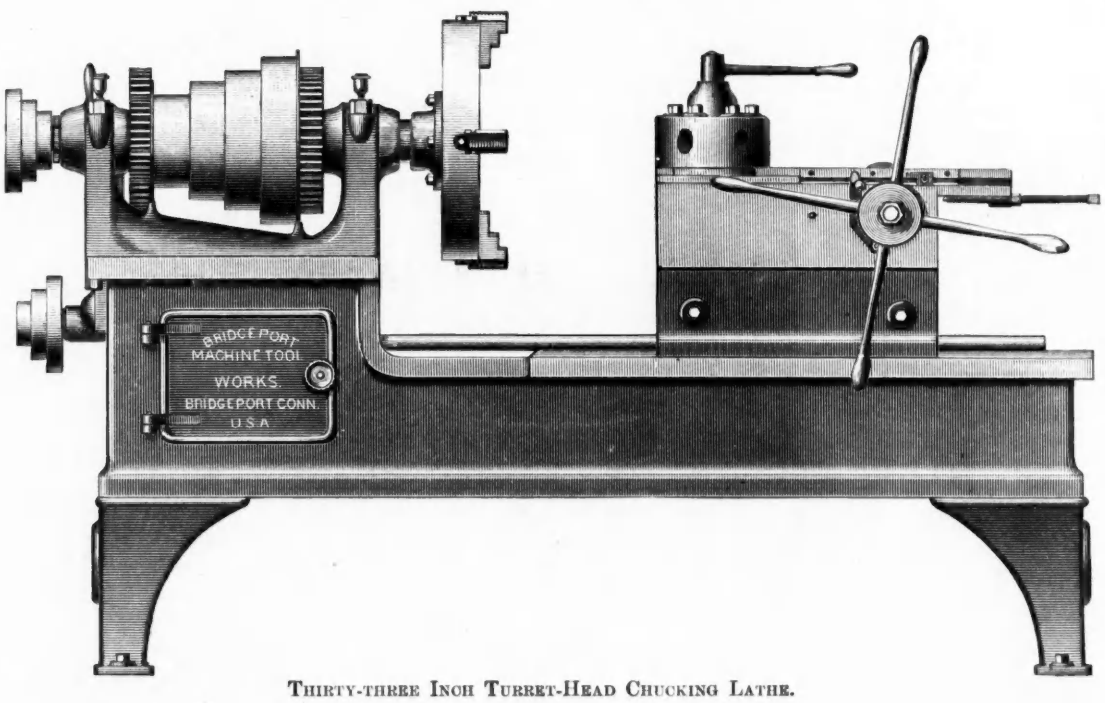
"Joseph, how did this happen?" "Well, Mr. Carson, you see I was going to face off the hub a little and I drove in the mandrel a little too tight, and away it flew. I am very sorry, but you know you told me the other day that I must put them mandrels in firm." And he had, from the looks of the mandrel and the wheel, which had a hub $3\frac{1}{2}$ inches long, with 1 inch or perhaps $1\frac{1}{4}$ inch hole. He must have hit it with a 15-pound sledge.

Sam held in, he knew that it was nothing but gross carelessness that caused the trouble, but he answered with dignity: "Joseph, this is a very serious matter; that job was promised to-night, and now I don't know what will be done; but go back to your work, you will find a shaft in the blacksmith shop, get it and I will explain what I want."

Joe departed. "Well," said Sam, "that is too bad, too bad, that boy is a trial; it seems that I can do nothing with him."

I said, "it seems that you *are* doing nothing with him." "I don't see what I can do." "Do?" said I, "why I would have belabored him with a club, if I could not have done anything else." Sam looked shocked. "Well," he said, "there is one good thing about the boy, he always comes and tells me; he never dodges." "Dodge, thunder," says I "there is nothing to dodge; if that boy ain't a sneak I never saw one." Sam began to get mad. "Yes," he said in that sarcastic way of his, "you would have sworn until things were blue, but I trust I have too much dignity for that. I would never allow a man to swear at me, and I will not swear at any of my men. I propose to treat them just as I would want to be treated."

Then we got at it again. Sam says I have got the worst temper for a lazy man you ever saw. I told Sam there were some cases that justice could not be done to without strong language. You talk about dignity; if that dignity of yours would strike in, it would kill you. You say you want to treat men as you would want to be treated. That's all right in sentiment, but it won't do in running a machine shop. Treat men as they deserve. Talk about wanting men to respect you, there are some men that I don't want to respect *me*. You may have to come down and go to work at the lathe or vise again; well, if you do, you had better hunt another shop. You act as if you were afraid of your job; if you are, you had better get out. Who are you working for, anyway? You are foreman of this shop. I knew you when you used to work at the bench, and you and I both used to do things when we worked at Barber's that I would not tolerate in a shop I was running. If you do, you ain't fit to be foreman. We were honest, or thought we were. We were zealous labor reformers. You remember when Barber cut wages, we all hands cut our hammer handles off. Do you remember how we ran Tim Dalton out of the shop because he took a job that Jim McFarland threw up on account of the reduction, and yet the wages were 25 cents higher than Tim had been getting down at Norwich. But we were honest in our views. Honest! well, we knew that there wasn't a better man to work for than Barber, that after the reduction he paid better wages than was paid by any shop in Worcester County. Honest! we were not a bit more honest than the average machinist is to-day, or the reverse, if you please. There are cranks in every shop, and if you don't keep a tight rein on them, they will ruin you. You believe in treating them like men; if they are men, so will I, if they are half men I will treat them as such, but bear in mind I am to be the judge; for in my experience I have found that the man that amounts to the least thinks he amounts to the most.



THIRTY-THREE INCH TURRET-HEAD CHUCKING LATHE.

New 33-Inch Turret-Head Chucking Lathe.

The engraving of this machine represents one brought out at the Bridgeport (Conn.) Machine Tool Works, and sold by the proprietor, E. P. Bullard, 14 Dey street, New York.

This machine is intended for use on all kinds of work where holes are to be bored; a number of operations can be performed without removing the work. It is strongly back-geared and has a heavy spindle, with a hole $1\frac{3}{8}$-inch diameter through it. The turret is large, is self-revolving, and has self-feed to the slide, with convenient stop-motion. The pan underneath keeps the floor clean.

Sixth Annual Meeting of Mechanical Engineers.

The sixth annual meeting of the American Society of Mechanical Engineers, in Boston, last week, was not only well attended but thoroughly interesting. A number of practical papers were read and discussed, and several topics suggested at the time brought out much valuable information, as the members gave notes of their experience regarding them. The local committee deserves much credit for their arrangements for making the stay of the members pleasant. Several ladies were present. In the intervals of the sessions some agreeable excursions were made, and on Wednesday evening the society partook of an excellent dinner at the Parker House, which was tendered them by the city. Upon assembling on Tuesday evening the members were received by a speech of welcome by Mayor O'Brien, after which they enjoyed a social lunch.

The following officers were elected for the ensuing term: President, Coleman Sellers; Vice-presidents, Olin Landreth, Chas. H. Loring, Horace See, Allan Stirling; Managers, Hamilton A. Hill, William Kent, Samuel T. Wellman; Treasurer, William H. Wiley.

DISCUSSION OF PROF. SWEET'S PAPER "THE UNEXPECTED, WHICH OFTEN HAPPENS."

(*Paper given in full on page* 4.)

Henry R. Towne said he would mention a little case in his own experience of the unexpected. "The question," said he, "was to harden steel castings which were very small and light, weighing but a fraction of a pound, and the part which it was desired to harden being very thin—from an eighth to a sixteenth of an inch. The castings were got by the open-hearth process. It was stated that similar castings had been hardened in considerable quantities, but on their being brought to me I found they would file nicely. Other attempts were made with no better success, and I found ultimately that the only way we could produce a casting that would not file was by using silicate of potash, which took a good deal of time and was very expensive. Finally it occurred to us to break the castings open, and, to cut a long story short, it came out that the steel hardens beautifully inside, but that there was on the outside of these castings a thin skin of metal .03 or .04 inch in thickness, and in filing I filed this and did not go deeper. And the moral of this is to look below the surface."

George M. Bond said that he discovered the same thing in making heavy columns. The hardening did not take place on the surface. He thought that sometimes the castings might be over-annealed on the outside.

W. F. Durfee gave an account of an ordinary locomotive boiler which he had in use, and which his man, after two or three weeks, said had "the devil" in it. The lever was up in the air, and not a bit of steam coming out. Mr. Durfee pulled the lever down, and it came down easily and began to go up very gradually. He found the trouble was that the valve-seat was made on a bushing of brass. The bushing had got loose and the steam had got under the bushing. The consequence was that the valve, bushing and all, acted like a piston-valve.

Prof. Wm. A. Rogers said that the unexpected had happened to him in the matter of hardening and tempering steel. The difficulty of tempering a large mass of metal was so great, in his experience, that it was never perfectly done. The test he applied was to take a bar of steel of any length and temper it as perfectly as possible, and draw lines upon it with a constant pressure of the diamond; and he never yet had seen a case where the lines were all alike. The diamond cutting on this polished surface detects the lack of homogeniety in the most perfect way.

George W. Hammond said he would like to ask whether the inequality in the hardening of steel was not due to the steam formed against the steel itself?

Mr. Ashworth said that in a business in which he was engaged some years ago a certain casting was desired, and in order to get one that would exactly suit the purpose, a dozen would be ordered and the remainder rejected. After a time an outsider suggested that these castings be made upon a shearing, and, as is frequently the case, it was hooted at as impracticable, but in the course of time was brought to the test. But the misnomer of having a "chilled core" was applied. The result was marvelous, and after it was brought to America, this simple matter of putting this iron core, covered with a lubricant, into the work, revolutionized the business, and instead of 15 castings being ordered and thrown away, they were all suitable for use.

Oberlin Smith, of Bridgeton, N. J., said that he lately had occasion to make a little cup, about two inches deep and three inches in diameter. Into it he wanted some water to leak through a hole in the bottom at a certain definite rate, on the principle of the hour-glass. He made a hole in the bottom, which was about $\frac{1}{32}$" thick and $\frac{1}{64}$" in diameter. The cup was of brass. He found that the water did not leak in unless the cup was submerged more than an inch. He found also that by making the hole larger at the end it leaked in much more readily, and that by thickening the bottom of the cup at a certain place, and with the hole tapering from $\frac{1}{32}$" at the bottom to $\frac{5}{32}$" at the top, he got the best results.

W. G. Richards, formerly with Mr. Corliss, of Providence, R. I., has accepted the superintendency of the works of the Allen Paper Car Wheel Co., at Hudson, N. Y.

Railway companies that fail to equip their trains with approved safety devices are, in most States, held answerable to the same. It will by-and-by be found more profitable to adopt such devices than to pay the damages resulting from not using them.

Feed-Water Purifier.

This is a device for removing impurities from the feed-water by submitting it to the same heat as the water in the boiler, by which means the impurities are precipitated, and prevented from entering the boiler.

The water is fed in at the upper pipe *D*, passes down and up the central pipe, as shown, being highly heated in its passage. It is then sprayed from the top of this central pipe, falling down over the spider-like projections, by which it is subdivided and thoroughly subjected to the temperature due to the pressure of steam in the boiler, precipitating the foreign matter. The whole mass then passes down through the concentrating tube shown in the lower section of the cylinder to the mud-well at the bottom. The separation of foreign matter from the water is here completed, the deposit remaining in the mud-well, from which it is from time to time blown off. The purified water rises and passes to boiler through pipe *C*.

The advantages claimed for this purifier are, that it will keep boilers from scaling, and that from feeding water free from scale-making ingredients, any scale that is on the boiler will be gradually removed; that it will prevent foaming, because purified water only enters the boiler; that there will be no leakage from unequal expansion and contraction caused from comparatively cold water coming in contact with the sheets; all the water entering the boiler will be of a temperature nearly equal to that of the water already in the boiler.

The purifier can be readily cleaned, either by washing or blowing out; by closing valves on pipes *B* and *C*, and opening blow-off *E*, it can be washed out, or by closing valve on *C*, and opening *E*, it can be blown out.

The manufacturers are Whetstone & Grau, Philadelphia, Pa.

The Unexpected which Often Happens.

BY PROFESSOR JOHN E. SWEET, SYRACUSE, N.Y.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

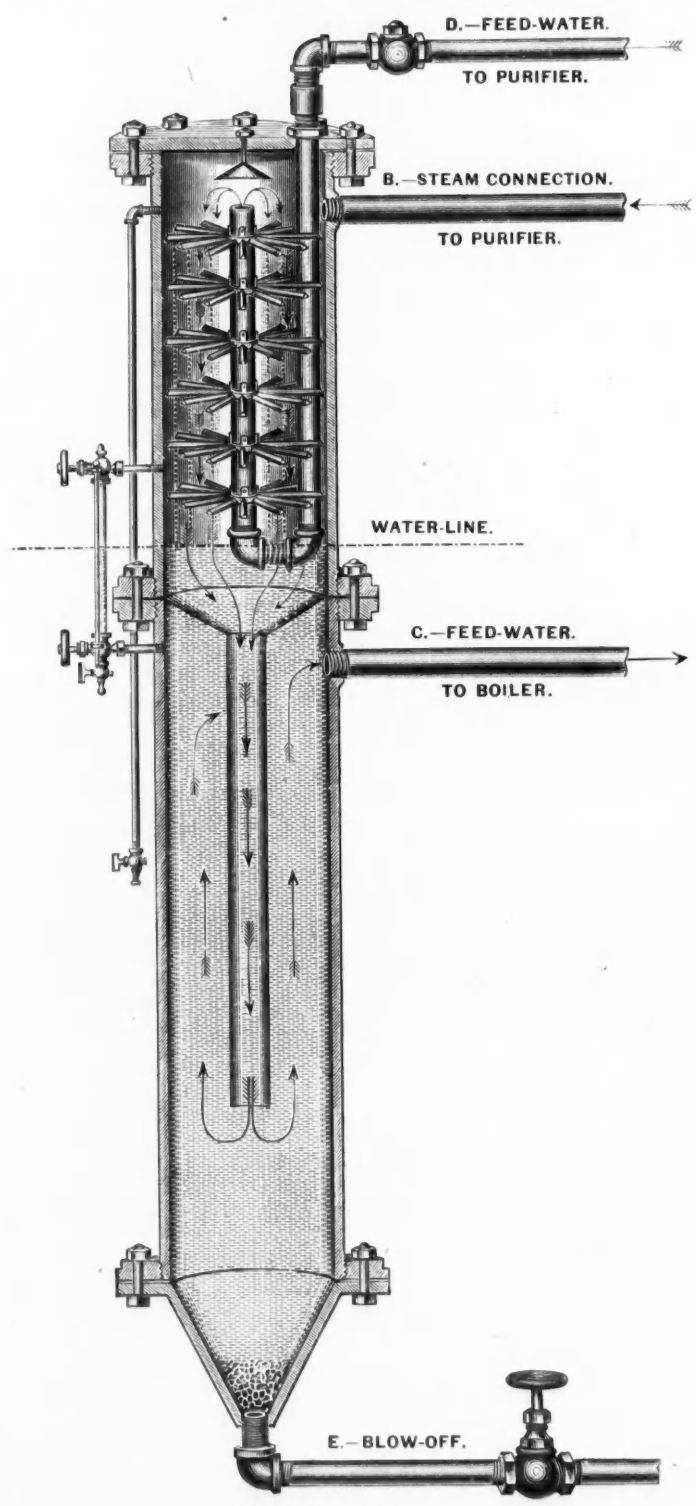
If we had no experience or knowledge, or no knowledge of the experience of others, everything which happens would be unexpected. It is not so much the unexplainable as the unexpected which attracts our attention, excites our astonishment, or disturbs our mental equilibrium.

The man who devotes his life to experimenting with practical mechanics, is sure to meet with the unexpected, or else to be too wise for his generation. Some of us do not care to admit that we were ever caught with the unexpected, but I beg to expose a few of the many things that have come upon me unexpectedly, in the belief that they may be of use to others, and in the hope that others will explain their experience, that we may profit in return.

Things perfectly familiar to mechanics engaged in one branch of industry, are often matters of great wonder to workers in another branch. Men may work a lifetime in cast iron as applied to tools and machinery, and yet know nothing of what it will do in the heating stove of a blast furnace. To such a man, the discovery that cast-iron heating pipes grow from six inches to a foot in length by use would be unexpected. To tell the blast-furnace man that certain core bars used for casting pipes, changed their length by three inches in casting twenty or thirty pieces, would be no surprise, until you supplemented the statement with the fact, strange to him, that they grow shorter, rather than longer.

Another example of a strange fact, well known to plumbers, and not to many others, is what is called an "air-trap." What that is can best be explained by an example: A cistern in the roof of a house has a pipe leading from near the bottom down to the cellar, along the cellar bottom and up to a wash-basin of the ordinary sort. When this cistern has once been filled and then emptied and again filled, air is trapped in the pipe. When the basin cock is opened, the water will not force the air out and be discharged at the outlet as most mechanics would suppose. You ask the plumber about it, and he will say, "Why, don't you know what that is? That is an 'air trap.'" You say "Oh!" and venture to suggest that you should think the water would force the air out. The plumber says, "It is an 'air trap,' and how can it?" You say "by gravity;" then he says, "Oh!" and you finally come to the conclusion that possibly he knows just as much about what an "air trap" is as you know about gravity, and no more. The thing is explainable of course, but is likely to come upon most men unexpectedly.

The unexpected sometimes comes from causes perfectly self-evident, after the thing had happened (as was the case in my experience by the clogging of a nail machine by the scale from the nail plate), and other times from causes utterly unexplainable, or from causes which are difficult to fathom.



FEED-WATER PURIFIER.

In practice, we use with a fair degree of success, for a piston-rod packing, simply an easy-fitting babbitt bushing. When these bushes become worn so as to leak, we close them up by compressing them in the water cylinder of a sort of hydraulic press. In this operation a mandrel somewhat smaller than the piston-rod is put inside, and with all the pressure we can bring to bear, we have never been able to compress the bush so as to grasp the mandrel tight, and yet in two or three cases, perhaps a half dozen, we have had these bushes (one of them after running a year) shut down while the engine was running, so as to grasp the piston-rod as if gripped in a vise, in fact so as to break the bushes asunder, or so that we had to resort to destructive measures to get them off.

In the formation of embossed work, male and female dies are used, and the female dies are often made by driving the hardened male die into a block of soft steel. This operation is easily performed by a few blows of the drop-hammer. It drives in and raises the soft metal without distorting the block in any other respect. Whereas, if the same operation is attempted by means of the hydraulic press, the block may be upset one-fourth its depth, the sides bulging out or the piece crushed without producing any impression of the male die further than a slight line-marking of it.

The unexpected comes upon us both by things not working when we think they ought, and by their working when common reasoning would indicate that they ought not. The man who first invented or constructed a lawn mower, must have been thought an idiot (or at least a man not familiar with the common laws of mechanics) to have imagined that he could with two light wheels get traction enough to rotate a cylinder six times their own weight, at six times their own velocity, and cut the grass in addition. The worm that drives the bed of a Sellers planer, does not wear out half as fast as it ought, and I fancy there is something unexpected about it, even to the makers themselves.

An engine with a 12 x 18-inch cylinder had been running a year at 185 revolutions per minute, standing usually quiet on a cut-stone foundation. One day, without any apparent cause, it began to shake endwise, and before night had shaken itself loose and had a movement of three-sixteenths of an inch at every turn. The engine being self-contained, no harm came to it, except the loosening of the foundation, and as the work was of more consequence than the foundation it was allowed to go on with a view to repairing it at vacation time, a month ahead. Before vacation time came, the shaking stopped without any more apparent cause for its stopping than that which caused it to shake, and the engine continues to run perfectly quiet notwithstanding the shattered foundation.

One of our well-known electricians built and tested for three years a certain piece of apparatus which promised to be of extensive application. It worked perfectly, and was as good at the end as at the beginning. A large amount of capital was put into buildings and plant, for the production of these pieces of apparatus for the market, and a good many were built, but in no possible way that all hands could devise were they able to reproduce the original, either in effect or durability. I make this statement at second hand, but believe it to be true; first, because of the source from which it came, and second, because it seems the only explanation reconcilable with the action and business character of the parties interested.

The unexpected often happens to the scientist as well as to the practical man, as must have been the case with Crooks, when he invented the Radiomotor. The story goes that he first invented the thing and then made it. But it turned out as tradition says the ship did, when some genius blew into the sails with a bellows; it went the other way. We laugh at the stupidity of the man with the bellows; the next generation may laugh at Crooks.

I venture the guess that there is many a man of science who (knowing nothing of the rolling of railroad rails), if asked to dictate as to which way the rail should be bent, to have it come straight when cold, would find that the unexpected would be likely to have happened twice when he saw his plan put in practice.

The case is reported to me where the unexpected happened to two boilers, and they did not blow up either. Two boilers alike in size and shape were connected by necks of considerable area, both at the top and bottom and the connections, both of steam and water, were without check valves. A fire was built under each of the boilers, which were both half full of water, and when steam was raised to working pressure the generators began to play shuttlecock with the water. It first went all into one boiler, and then all into the other. When the play got to its height, the boss, considering the premises and the lives of the men of more consequence than the cause of science, ordered the fires drawn, and the cause or consequences were never settled.

In the case of an engine which was more than twice too large for the work it had to do, and which could not be reduced to one-half the speed conveniently, it was decided to bush the cylinder to about half its area, with a view, of course, to the saving of coal. The result was that it took a little more coal than before. I think that this result was one which would have been unexpected to most men who did not know of the experiment having been tried before.

For casting a chilled die to be used under a drop-hammer, old chilled car wheels were used, and in which fourteen per cent. of spiegeleisen was melted under the expectation that a good chill would be produced as had been our experience. The first surprise was to find that the die showed no evidence of chill whatever, and could be filed easily. Some pieces of work were required at once, and the die was put in with the expectation that it would only serve for a few, but the second surprise

came when its endurance proved to exceed the best of the chilled dies as two to one.

A large percentage of the unexpected comes in the development of original inventions. When in the experimental stages it is easy to brand the inventors fools or lunatics, and when predicted failures succeed, it is easy to forget that we ever expected anything else. It is not always the ignorant who are wrong, or the best informed who are never in error. If ten years ago the possibility of conversing with people fifty miles away had been publicly suggested, it would have been only accepted by the ignorant, who, remembering the marvels that have been accomplished, would in their blind faith admit of its possibility, while the best informed would have been staggered at the suggestion. Less than ten years have rolled away, and it is an every-day occurrence.

An engineer put in charge of our electric-light station, found them using oil of 26 gravity, for lubricating the engine and dynamos. Even when the oil was used freely, the bearings would warm up and sometimes get hot. It was the practice to increase the quantity of oil, as the journals got warmer, and turn on water, when the oil would run all over. To the engineer's surprise, one night, he discovered that one of the bearings kept cool, and he noticed also that the oil cup was feeding only about one-quarter as fast as had been the practice. The happy idea of "letting well enough alone" occurred to him, and he found it continued to run cool. In experimenting, he proved that by feeding little enough oil, he got the other bearings to run cool also, upsetting the generally accepted notion that the white man entertains about oil and the Indian about whiskey, which you will remember is that "a little too-much is just enough." Whether the machines were endowed with homeopathic proclivities, whether the ubricant was of a high potency, or whether the result was due to the personal equation of the operator, are questions about which there may be difference of opinion.

The Niles Car-Wheel Lathe for Turning Steel-Tired Wheels.

The following description of this lathe we take from the advance sheets of a treatise on "The Turning of Steel-Tired Car-Wheels," issued by the Niles Tool Works, Hamilton, Ohio. The treatise contains much other information on the subject, from which we may quote in the future.

This lathe resembles, in many respects, the ordinary double-headed driving-wheel lathe. There are two head-stocks. The left-hand one is bolted rigidly to one end of the lathe-bed, and the right-hand one can be shifted upon the lathe-bed. This shifting is effected by means of a hand-lever provided with a rachet and operating a pinion which gears into a rack in the bed. When this head-stock has been adjusted in a proper position it is secured. In this lathe the ends of the car-axle project their full length into recesses at the center of the face-plates, and this shifting of one of the head-stocks is to enable the head-stocks to be closed up toward each other so as to bring the face-plates close up to the car-wheels. Each face-plate has two drivers which engage bolt-heads or other projections upon the outside face of the car-wheel. These drivers are adjustable in length to suit different styles of wheels, and the distance between the face-plates is reduced as much as the presence of these adjustable drivers will permit. The drivers are adjusted radially upon the face-plates for different sizes of wheels, and their driving-ends have jaws which engage the bolt-heads of the car-wheel. The engagement is not direct, however, as a circular collar is placed upon the bolt-head so as to afford a cylindrical bearing surface for the driver-jaws.

These drivers need no adjustment after being once set for a given diameter and style of wheel.

The left-hand head-stock supports the driving-cone from which gearing communicates motion to the back-shaft similar to a driving-wheel lathe. This back-shaft carries a pinion gearing into each face-plate; and on the right-hand end of this shaft is Placed a slotted crank from which a connecting rod transmits oscillating motion to a feed-shaft at the front of the lathe-bed which effects the feeding of the two slide-rests. The tool-rests can be bolted in position to suit the usual variation in the diameter of car-wheels, and the slide-rests have a range adapting them for work of standard gauge and five-foot gauge. The slide-rests swivel so that any desired coning can be given to the treads of the wheels.

Each of the head-stocks carries a sliding center-spindle. In this respect the head-stocks may be looked upon as tail-stocks, as neither of the lathe-centers revolves.

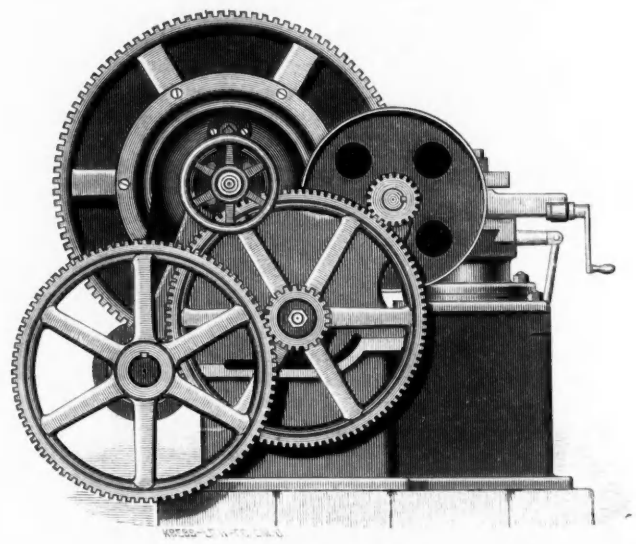
The axles may, if desired, be carried upon the lathe-centers while the wheels are being turned, and the lathe thus presents facilities for doing the work upon two dead-centers.

The lathe has no live spindles. The face-plates revolve upon rigid noses projecting from the head-stock. The only duty of the face-plates is to revolve the work, and the truth of the work is not dependent, in any degree, upon the character of the fit of the face-plate bearings, which is exactly the reverse of all lathes provided with revolving spindles. The noses on which the face-plates revolve have a large central cavity into which the journals of the axle project. In these cavities are located journal-boxes. These journal-boxes engage the axle-journals and furnish a rigid support for the job, the lathe-centers, in such case, having caps which serve simply to prevent end motion of the axle. The journal-boxes referred to are in the form of four-jawed chucks whose jaws have broad pads to form the bearings. These jaws are opened and closed by means of a wrench engaging a square shank projecting from the head-stock at the rear of the face-plates. This shank revolves a screw within the head-stock cavity, and this screw operates the wedges of the chuck.

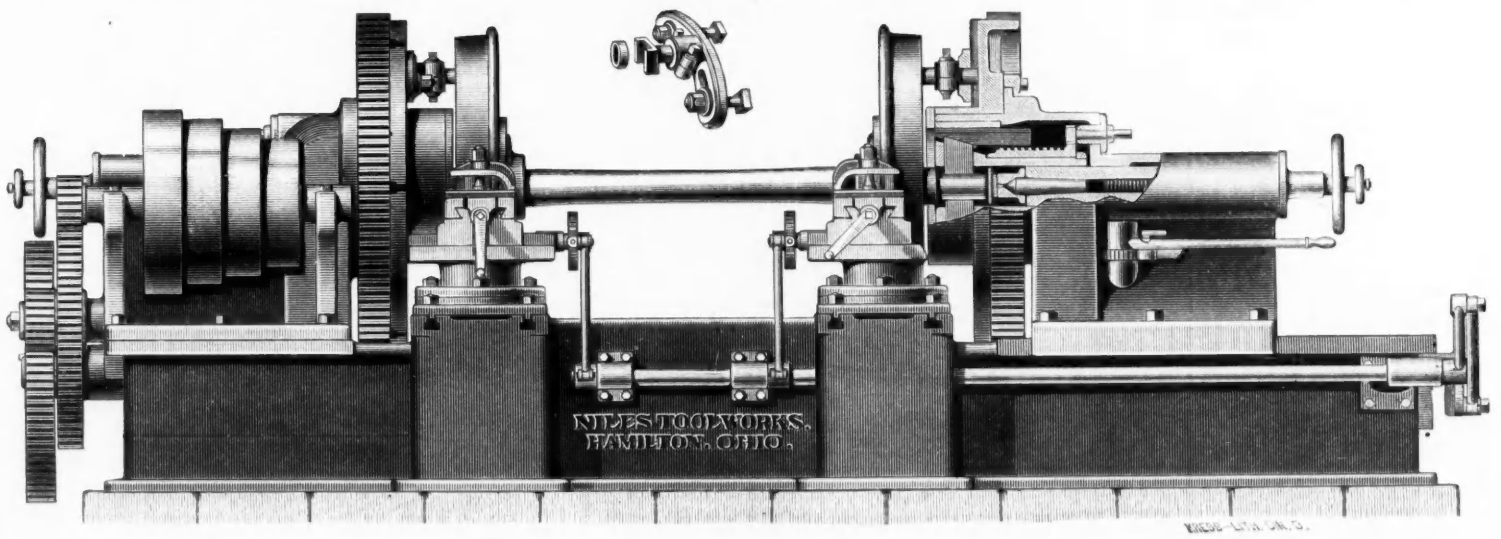
It will thus be seen that the car-axle is supported in rigid bearings and guarded against end motion while the wheels are being turned.

The bodies of the chucks are turned truly cylindrical and are fitted to revolve within the bore of the cavities in which they seat. The chucks may, if desired, be clamped tightly to the axle-journals so as to revolve with them.

In this case the outside of the chuck-body becomes the journal in place of the axle-journal, the chuck revolving with the axle. We thus still have the axle revolving in rigid bearings even if the axle-journals are not in good shape.



END VIEW OF LATHE.



NILES CAR-WHEEL-LATHE FOR TURNING STEEL-TIRED WHEELS.

It is not always the uneducated, the insane or the stupid who produce failures, nor the best educated, most thoughtful, or most experienced who bring out everything according to the original intention. The unexpected comes to the good and bad alike, and so in our teachings to the young and our planning for ourselves, is it not well to have our statements and our speculations pretty well saturated with the elements of uncertainty?

It is an old and common custom to use the statement that "two and two are four" as an example of the certainty of certainties, and another; that "like causes produce like effects," while as a simple matter of statement, the first can be easily shown to be twenty-five per cent. off, and the latter to hold along all the way from like results to results diametrically opposite.

Mr. Heaton, an engineer, and one of our old subscribers, recently made us a call on his return from Shanghai, China. He says he had no difficulty in obtaining the AMERICAN MACHINIST every week from news-stands in that city.

LETTERS FROM PRACTICAL MEN.

Drying Cores by Steam.

Editor American Machinist:

In reply to Mr. R. E. Masters' inquiry, as to drying cores by steam, the Haxtun Steam Heater Company, of this place, are successfully using steam in drying cores, and have been for the last twelve years, and the same has always worked entirely satisfactorily to them.

They make a specialty of gray iron steam fittings such as **L**'s and **T**'s, all sizes from ¾" up to 10" and 12" diameter, and such work requires a great many cores. They also make a great many brass globe and check valves which uses up a large amount of cores, besides this they do a large amount of general foundry work, and employ from 75 to 85 moulders altogether. They run six core ovens and use live steam direct from one of the large boilers that run the works, which is set about one hundred feet from the ovens, the steam pressure in boilers being about 80 lbs. and in the steam coils or pipes in ovens about 60 to 65 lbs. Higher pressures could be used and dry quicker, but the above has been sufficient in their work.

Should Mr. Masters or Mr. King need any more information in regard to the above we will try and be with them. Mr. William Cunningham is the foundry foreman, and will be pleased to give them an answer to any inquiries they may make in regard to the above. H. H. PERKINS.

Kewanee, Ill., Nov. 2, 1885.

Short Cut with Indicator Diagrams.

Editor American Machinist:

For the benefit of your readers who use the planimeter in measuring indicator cards, I send you a "short cut" which I have found very convenient, as it removes one part of the process of "working up" entirely, viz., that of reducing "area" to "height" or "pounds," and thereby lessens the chances for mistakes in figuring.

In taking diagrams with a 40-pound spring the drum movement should be adjusted to make the card just 4 inches long. Then in noting the planimeter reading, multiply by ten, or shift the decimal point one figure to the right. Thus: If the reading is 3.41 square inches, write it 34.1 pounds.

It is hardly necessary to explain that the usual process of dividing by four and multi-

plying by forty is the same as multiplying by ten.

With higher speeds and pressures the sixty spring can be used, in which case the card should be just three inches long and the reading multiplied by two, after shifting the decimal point as before.

This way is so simple that one can very easily make the calculation as he writes the number down, and where many cards are to be measured, the slight trouble of adjusting the drum movement to suit, can be well afforded. F. B. RICE.

Dunkirk, N. Y.

Old Idols Banished.

Editor American Machinist:

What will become of our idols? One of your correspondents has ruled out chalk; another scoffs at the spirit level; and the grindstone has long held its place only by real grit. One of my friends has a great contempt for plumb lines and their kindred, and maliciously calls them stretched strings. Another says there is no certainty about a try square, tip it a little one way or the other and it will fit almost anything.

And hammers, must they go too? Alas! I fear it from the way monkey-wrenches are used in their stead. OLD JOUR.

A Problem.

Editor American Machinist:

Here is a pretty good little problem for the boys:

The solid contents of a glass ball 1″ diameter are blown into a hollow sphere whose shell is $\frac{1}{16}$″ thick; required, the diameter.

First see how near you can guess it, and then work it out.

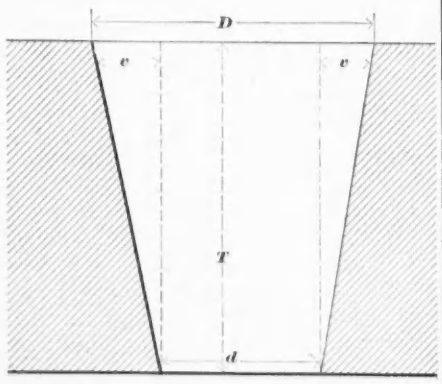
FRANK H. RICHARDS.

Taper Work with Graduated Compound Rest.

Editor American Machinist:

The writer has never been able to find the first lathe hand who could explain the use or value of graduations on a compound rest. Not, however, but what there are *some* who understand the subject, but there are many hundreds of machinists who do not have the slightest conception how to use the graduations when occasion demands it. There was a time when I found myself among that number. Some years ago I took up the subject for investigation, but did not find any one able to help me where I then worked. Finally a rule was deduced, which worked practically on small angles.

Some years later, having a little "Yankee curiosity" to find out mechanical matters, I consulted (at the same time) two or three on the subject, among them Prof. S. W. Robinson, of the Ohio State University, who very kindly explained the subject, as did also the late Mr. John W. Nystrom, whose explanation was in detail, accompanied by a kindly request to consult him any time. Mr. Nystrom always seemed to take great pleasure in solving mathematical inquiries presented to him, and always did it in such a kind manner as made you feel welcome to consult him. Below is a formula for setting compound rest to do taper work, as given



by Mr. Nystrom to the writer some time ago:

$$\text{Tangent V} = \frac{\text{D}-d.}{2\ \text{T.}}$$

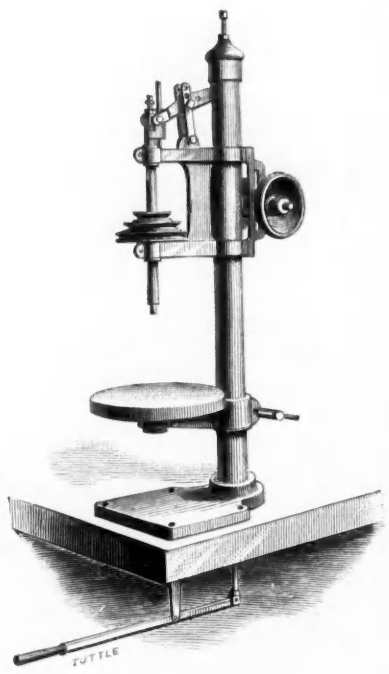
D—d is the taper in the thickness T.

Example: D=4″. d=3″. T=4″. Tangent V = 4″ — 3″ = 1″.

$$\frac{1''}{2\times 4} = .125''$$

Then, by consulting a table of natural tangents (for which see Nystrom's Pocket-book) we find opposite .125 to be 7 degrees and 10 minutes, which is a little too much, as rests are not graduated to minutes. I find the nearest quarter degree gives very pleasing results. RALPH E. STATE.

Lima, Ohio.



New Sensitive Drill Press.

This machine consists of a base plate from which rises a hollow post, through which passes a rod for operating the drill spindle. From the upper part of the post there extends outward a bracket which supports the drill spindle and pulleys for turning it. Between the bracket and base-plate is an arm which is adjustable upon the post and held firmly by clamping. Upon the arm is the work table, adapted to turn upon its center, or held from turning by a clamp. The drill spindle is fitted in gun-metal bushings, the lower one forming the bearing for the pulley which turns the spindle, and by this construction relieves the spindle from all strain from the driving belt. The pulleys can either be flat or conical to suit either form of belt. With the machine are furnished all the necessary attachments to make it complete.

The manufacturer is Charles C. Abbe, 94 First street, Brooklyn, E. D.

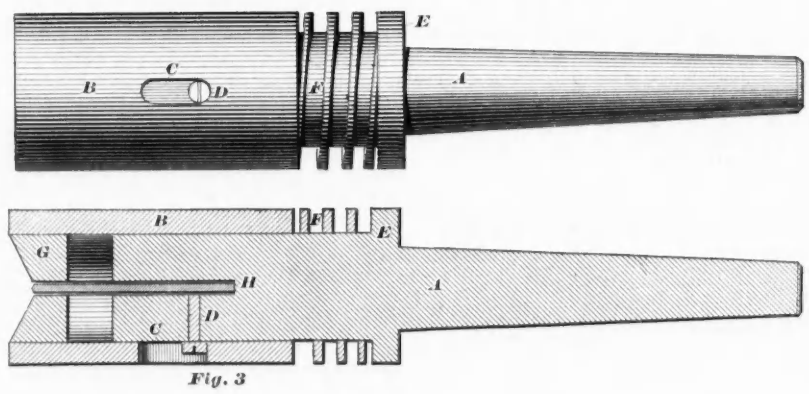


Fig. 3

Centering Studs.

BY JAMES F. HOBART.

There was fun all around that little 8-inch lathe. Joe has got 200 little studs 1½″ long, $\frac{3}{8}$″ to $\frac{1}{2}$″ diameter. He has got all those studs to center and turn up.

"Why didn't he do the job in a turret-lathe, and turn them up before cutting off?" Well, that would have been a first-rate way, but Joe didn't have a turret-lathe, and the studs came into the shop all cut up.

Joe put a piece of iron with a $\frac{5}{8}$″x1″ hole in it into the vise, and went for those studs with a center-punch and hammer. After he had punched a dozen, he got a drill into his old lathe and began drilling centers. Next, a forked tool was put in the tool-post, a countersink into the tail spindle, and Joe began truing up the studs. It was a pottering job, and after it was done the centers needed to be drilled again.

Joe omitted the first drilling, and got along better; but it was a tedious job. He cast longing glances toward the old centering machine, but that "thing" was "on a strike," and was no good for such small work anyway.

Joe began to do a little thinking as he was punching, countersinking and drilling those little studs. He thought of a little funnel on his center punch, so it would hit the exact center every time. Then Joe thought, "why not put that funnel on the drill?" "By jingo!" said Joe, "Iv'e found it!" He took a piece of soft steel and turned it up like *A*, in Fig. 3. He turned on the shoulder *E*, and drilled in a small hole at *H*, fitted a little twist-drill to it, and put in the screw *D* to hold the drill.

Next, a piece of steam-pipe was reamed out to fit on *A* at *B*. This pipe was turned to the size of collar *E*, and held by the screw *D*. The hole *C* was slotted so *B* could slide toward *E*, and a spring *F* put in to keep it snug against *D*. Joe got a piece of nice cast steel, turned it like *G*, to fit nicely in *B*. He hardened *G* as hard as water and fire could make it, and forced it in place. The shank of *A* was fitted into the spindle of the lathe and made to run true.

How Joe laughed when he started up the lathe on the fast speed, dipped a stud in the grease dish, and put the greasy end into *G*! How that little drill took hold when he ran the tail-spindle against the other end of the stud!

"Both ends of thirteen studs in a minute," said Joe, as he knocked out the rig and put in a countersink. "And this will finish the job. The drill holes are so nearly correct that I will not have to re-drill them after countersinking. I believe I can make another tool, and put a countersink rig right on to the drill *H*. It will not work iron quite as small, but it will do the whole job."

"No, it is not patented," said Joe. "Give it to the boys, and tell them they can see it down at J. W. Dewers' shop, 33 North 7th street, Philadelphia.

Turning the Tables.

The Chinese cigarmakers, sixty in number, employed in a San Francisco factory, recently struck because the firm refused to discharge their white workmen. The white men must go, says the Chinese union.

The *National Labor Tribune* says: "It is hoped that before many years there will be a road-construction system adopted which will employ convicts extensively upon improvements which would not be made but for the supply of this description of labor. In some of the Western States, notably Missouri and Illinois, this plan has been in course of serious consideration, and as good roads to the railways are of paramount importance in both these States, it may be their legislatures will have the common-sense economy to adopt the scheme in time for a beginning next open season. There is every reason why prison-labor should be thus employed largely in all the States, and in case it were, the big end of the convict employment problem would be happily solved.

Scientific Systematic Method in Ordinary Mechanical Occupations.

From advance sheets of the *Journal of the Franklin Institute*, we reproduce the principal part of a lecture delivered by Coleman Sellers before the Franklin Institute, of Philadelphia, November 6:

I propose, this evening, saying a few words to you on the part that systematic, scientific method plays in the most ordinary mechanical occupations, and to point out the need of orderly method in the advancement of all the arts. I had occasion, the other day, to watch the operation of a mechanical shoemaker, at work in the Novelties Exhibition. Boots and shoes were being sewed on this machine, the stitches made with brass wire; brass staples were selected, automatically, of the proper length, and were inserted in place. My attention had been critically drawn to this machine in acting as judge in the class to which it belonged; not very far away were books, which, in binding, were sewed with wire staples, and between the two were many devices to enable hand-sewing with wire staples to be done with ease. My mind naturally grouped these objects and processes, and even flew back over many, many years to days of childhood, when I had learned one of my first lessons in mechanics from my father, who held me in his arms, so small was I, as he showed me the then great wonder of fine steel wire bent in a machine into staples and driven through thick leather in rapid succession, to form the fine teeth of the cards used in carding wool and cotton fiber. I was not at, say, four years old, too young to remember the lesson when it was facts that were given me to think over. He took good care to point out that the fine wire forming the staple was driven through the leather with unerring precision, and without any holes having been pierced for it by more rigid needles. The card clothing machines at Cardington were driven by water-power, but this mechanical shoemaker at the Novelties was driven by a steam-engine of the highest type. That steam-engine had its lesson to teach; a life, too, could span much of the period of transition from the first crude machines that grew out of Oliver Evans' notion of a high-pressure engine to the work of Corliss and others of to-day. It had made but little advance, even as early as I can remember, as compared to the results of to-day, and its slow growth had been after the manner of the survival of the fittest. Its history is cumbered with a vast amount of negative information, by years of mistakes, the results of empirical methods as against the systematic mode of more modern research. As the steam-engine grew towards its present state of perfection, in spite of the many drawbacks, the theory of thermo-dynamics took shape. The practical mechanic, who prides himself on the grand fact that he has drawn all his information, as it were, through the handle of the hammer he has worked with, has a holy horror of all that savors of science, and, what is more, he holds in contempt the scientific engineer. It was one of these practical men who presented a contrivance of his to a railroad company for trial; some of the directors thought it would be well to investigate, and the trial was made. The inventor afterwards said that the failure was due to the scientific experts who conducted the trial. He suspected they had put some thermo-dynamics, or some other scientific stuff, into the boiler, on purpose to prevent his device from operating. Now, thermo-dynamics is the name given to the science that takes into consideration the co-relation between heat and work. The designers of the great engines of to-day have the advantage of a pretty thorough knowledge of the laws that have been found to govern the conversion of heat into motion and of motion into heat. Could a knowledge of thermo-dynamics have preceded the steam engine, there is no telling how much farther we would have been now in our motive-power department of the world's industries.

We are living in an age when the Baconian inductive system of research is relied on; the rapid progress of modern times is due to the results of the inductive system. In old times, the philosophers contrived theories to account for known facts. Lord Bacon was the one who clearly pointed out the need of obtaining many facts and finding the laws that govern matter through and by the study of the facts, but going beyond the range of the facts that we can obtain for the purpose of investigation.

The old philosopher stood on a hill and saw the land spread out before him as a mighty plane, and, as he watched the movements of the heavenly bodies, he saw them rise in the east and sink below the horizon in the west. Upon this visible fact he concluded, with the more modern colored preacher in Virginia, that "the sun do move," because he saw it move; and so, from this visible fact, he proceeded to build up a theory of astronomy, and hunted for other facts to sustain his theory.

A more modern inductive philosopher,

under the same conditions, perhaps, notices that objects floating on the surface of the sea sink out of sight at the horizon, and as these bodies are moving, hence infers that the surface of the world is round, and, gathering many more facts, he then draws conclusions from his observation that enable him to look farther ahead and foretell, as it were, greater discoveries.

The wonderful progress of modern times is due wholly to the method that has been pursued of grouping facts in proper order, working out laws that govern matter, and proving that the laws are correct by finding no exception to them. An established law is what explains all phenomena bearing on it, and when no known fact offers any contradiction to it. Established laws are many, and the knowledge of these laws makes the wisdom of the modern scientific mechanic. There are laws that can be so thoroughly trusted that we no longer need investigate, and we follow them with confidence, knowing that we cannot change them, if we would do so. Gradually the knowledge of the world has become formulated, and we have in simple form, ready for work, the accumulated knowledge of all who have preceded us. We have before us, it is true, a vast field of experimental research, but we are in the position to guide our work systematically by the lights we now have. The day for empiricism in mechanics has gone by, and I wish to show you this with a few simple illustrations.

I have here a ball attached to the end of a piece of string; the string seems strong enough to carry the ball—at least, it does not break under the strain. I whirl the ball in a circle, and past experience leads me to infer that if I whirl it rapidly enough the string will break under a strain, due to the centrifugal force incident to the rotation. This fact is so well known to all of you that it is not needful for me to prove it by trial. We hear of fly-wheels and grindstones breaking when revolved too rapidly. If, for any reason, I should desire to keep up the rotation of the ball at the end of the string with safety, I must know the force exerted on the string during rotation, and I must know the ultimate strength of the strain. I have only to know the weight of the ball and its velocity in feet per second during rotation, and calculation will give me the strain on string more accurately than I could obtain it by experiment. Now, on the other hand, no amount of calculation will tell me if this particular string is strong enough to bear the strain with safety. To find out the ultimate or breaking strength of the strain, I must load it with an increasing weight until rupture takes place, and the information thus obtained can be used with some degree of certainty with the balance of the twine on the ball from which this was taken, or can be used to predicate the strength of another string of similar size and construction. This homely illustration will convey to your minds what I want to make clear, namely, just where we can rely on calculation, and where experiment must be resorted to continually. Let me now give you an example of the working of the scientific method in actual practice, covering a case involving calculations and experiment. Steam boilers have been made to serve the purpose of death traps from the most culpable neglect of ordinary precautions for safety, coupled with gross ignorance of Nature's laws, until the authorities were obliged to step in and define by laws certain precautions that must be taken for the welfare of the community. Steam boilers are made of sheets of iron or steel bent into shape and joined by rivets. As the strength of the entire structure is limited to the strength of the weakest individual part of the structure, it is of moment that the true value of any particular kind of riveted seam be known by actual experiment. There is no way of making the riveted seam as strong as the body of the metal. It is now usual, to so proportion the number and size of the rivets to the thickness of the plates to be joined, that the metal remaining between the rivet holes, shall about equal the strength of the rivets that unite them. In determining the pressure of steam a boiler already made can be permitted to work under, a calculation is gone into as to the strength of the seam, as measured by the area in section of metal between the rivets, and also measured by the size and number of the rivets, and the strength of the seam is assumed to be the lowest result of the calculation. After this, it may be necessary to know the strength of metal that forms the boiler, and just here is where the lesson of the ball and the string comes into play, and our present illustration is as readily understood. It does not require a very high order of talent to master the calculations that are resorted to, to determine what strain will come on this or that part of the boiler, and we have to rely wholly on calculation, for that information. The boiler must be made much stronger than its ultimate or breaking strength of the metal to insure its safety in use, and to allow for deterioration. The difference between the ultimate or breaking strength and the strain that it is to be subjected to in practice, is regulated by what is termed the factor of safety. All well-considered specifications for structural metal work, for instance, call for the material to come up to some established standard of ultimate or breaking strength, and the amount of metal to be used in the structure is determined by a factor of safety specified. This factor of safety may be as low as four, in some cases of boiler and bridge construction, when the known character of the material used warrants the course, or it may be as high as thirty, in the case of matter subjected to shock or blows, as in the case of rapidly-revolving gear wheels. That is to say, it may be considered safe to strain the structure to one-fourth of what would cause it to break, or the case may require that we dare not strain it beyond one-thirtieth of its breaking strength. The question now presents itself, how can every sheet of iron or steel to be used in the construction of a boiler, for instance, be tested, when such sheets are usually ordered from the mill of the exact size that is required, and to test a part of such sheet would destroy it for use. This furnishes me with a suitable example of the scientific method carried out with ease and certainty in every-day practice.

Steam boilers of locomotives are worked at a rather high pressure, say 120 or 130 pounds to the square inch, and the metal now mostly used in their construction, is steel of a low grade as regards hardness, that is, steel of considerable ductility. From the specification for boiler and fire-box steel issued by the General Superintendent of Motive Power of the Pennsylvania Railroad, December 1, 1882, I extract the following:

(1.) A careful examination will be made of every sheet, and none will be received that show mechanical defects.

(2.) A test strip from each sheet, taken lengthwise of the sheet, and without annealing, should have a tensile strength of 55,000 pounds per square inch, and elongation of thirty per cent. in section originally two inches long.

(3.) Sheets will not be accepted if the test shows a tensile strength less than 50,000 pounds, or greater than 65,000 pounds per square inch, nor if the elongation falls below twenty-five per cent.

(4.) Should any sheets develop defects in working, they will be rejected.

(5.) Manufacturers must send one strip for each sheet (this strip must accompany the sheet in every case); both the sheet and strip being properly stamped with the marks designated by this company, and also lettered with white lead to facilitate matching.

Now let me explain this specification to you, as it has been explained to me in the admirable test-room of the shops at Altoona:

There are many makers of steel boiler plate in the United States, and without referring by name to any one, I can state that the Pennsylvania Railroad has decided on a set of arbitrary signs to indicate each maker. One is designed by a triangular stamp, one other by a circular stamp that marks a ring of about one inch in diameter, another by a square of like size, and so on. Sheets of steel come from the rolls with a more or less irregular outline and of a size that will permit the tests strip to be cut off from one or the other edge without difficulty. The plate in the rough is, when cold, scribed to the required size of sheet that it is to be sheared to, and on the shear line two marks are made by the prescribed stamp, one mark being made at one blow of the hammer and the other by the same punch or stamp at another blow, and at any convenient distance from the other, but in no case are the two marks made by a twin set of punches or stamps at any fixed distance one from the other. This irregularity of the stamping renders the after matching of the strip, or coupon as it is called, an easy matter, with the sheet from which it has been cut, the shear cut being made directly through the marks. The matching is still further facilitated by numbers or signs in white lead.

After reception by the proper inspectors on the road, the samples, or coupons, are stamped with corresponding numbers after verification, and the test piece goes into the shop to be dressed to the proper width for the test, and the sample is then broken in a testing machine, and, in a book kept for that purpose, entry is made of every particular connected with the test, and the sheet received or rejected on this record. Suppose, however, that a sample shows a higher tensile strength than the maximum allowed, namely, 65,000 pounds per square inch, and that such specimen has an elongation or ductility as great as can be desired, it may be well asked why it should be rejected. In the book of record, I have seen some such cases, and reference is there made to the book of the chemist, into whose hands such sample is sure to go. His chemical test had in all cases, up to the time I saw the book, indicated too much carbon in the steel, and a simple physical test of heating and plunging the hot steel into cold water has shown it to be capable of being hardened. It is not deemed wise to employ any metal that has hardening qualities in the construction of steam boilers. After many such trials, the officers of the road have come to consider the tensile and ductility tests as final, and as expressive of the qualities wanted. Thus, you see every sheet in every boiler has its physical quality when new recorded, and its marks enable its after history to be noted. No sheet of steel can meet with mishap afterwards, without having the report of the mishap recorded on the page that marked its acceptance, and its life or durability also noted. Such, in brief, is the account of the admirable scientific investigation into the quality of the material used in boilers, as reduced to practice, and so persistently pursued by this one company as to be now no longer a subject of comment. This method of test, however, is the outgrowth of systems that preceded it. Practice and theory must agree. The scientific engineer can lay claim to the title only when he is abundantly fortified by sound experience, and has learned to view all things evenly.

In the specification of the Pennsylvania Railroad, as already cited, stress is laid on the percentage of stretch before rupture takes place in the required test. The date of the printed specification I have referred to, is 1882. On January 8, 1881, I had a letter from the General Superintendent of Motive Power, in which he describes other tests which had been used for a long time. These were bending tests.

(1) Bending cold.—A strip from each sheet must stand being bent over double, and being hammered down flat upon itself without fracture.

(2) Bending after being heated and dipped.—A strip from each sheet must stand being bent over double, and being hammered down flat upon itself, after having been heated to a flanging heat and dipped into cold water, without sign of fracture.

He informed me that the bending tests had been insisted on for several years, but that the certainty of the ductility test had caused them to make it the final mode of determining the quality of the steel submitted to them. In order to make the bending as uniform as possible, they adopted the plan of holding the strip to be bent between rigid jaws and striking the projecting end with a ten-pound sledge until it is deflected about 135°, when it was removed from the jaws and held with tongs while it was hammered down flat on an anvil. The bending after heating and dipping was added to protect them against acceptance of hard sheets, by reason of the test strips being annealed, accidentally or otherwise by the manufacturers. He said that for some time past they had been testing tensiley, to obtain ultimate strength and ductility, a piece from the strip sent with each sheet, and had established a tensile test, which supplanted the bending test, but covered the same ground that it did. This was done on account of the greater regularity and uniformity of the results in tensile test, and because by it they obtain figures to show the exact quality of the steel; so that even in 1881 they were working under the specification I have already mentioned, as furnished me in 1882. Time is an important element in tests, particularly so in bending tests. An expert giving testimony in a trial in which the reliability of the steam-engine indicator was in question, said: "I believe in the result of the use of the indicator when I know who works the instrument." The bending test is good, when you see it done in a proper manner, or know who does the bending.

Hurry the bending of good metal and it may break. Proceed with the bending of poor metal with caution, let it rest a bit between each blow, and a skillful man can bend a strip of brittle steel, so that the specimen will deceive the most expert. It is a very curious property of wrought iron and steel, that after being strained above the limit of elasticity and near to the point of fracture, rest will restore its strength. The story is told of some tests being made on beams for structural work before some officers of the Government. One maker strained a beam up to a point near to the breaking point, and then invited the Board to test some champagne, saying that he was willing to let the beam remain under its heavy load until after lunch. When the test was resumed, a strength was shown that could not have been reached had the rupture been hurried to completion and the metal had been allowed no time to accommodate itself to the strained condition.

Let me now go back to the consideration of material used in boilers. During the latter part of Mayor Stokley's administration, say about 1880, he, at the instance of the City Inspector of steam-engines and stationary boilers, and of the officers of an insurance company for inspection and insurance of steam boilers, appointed a commission to devise some fixed rules, whereby uniformity of rating could be insured as to the pressure at which boilers may be worked. I had the honor of serving on that commission, and am thus enabled to tell you that we found a set of rules in force which gave to all boilers of the same diameter and the same thickness of metal the same pressure per square inch, regardless of the quality of the metal employed in construction and of the nature of the riveted seams. Fortunately, however, our City Inspectors of steam boilers were practical boiler-makers and were familiar with the requirements and could refuse to pass boilers manifestly unfit for use, for men long familiar with work of this kind come to learn what is right by experience and good common-sense. The ordinances passed by conncils, at the suggestion of the commission, made it imperative that all the conditions that exist in each boiler as to nature of seams, thickness and quality of the metal used, should be considered, and the boilers rated accordingly, giving the greater latitude to good workmanship and good quality of material combined with judicious proportioning of the parts. At the time to which I allude, but a few years ago, the United States laws in regard to the testing of boilers used in the marine service, called only for a knowledge of the tensile strength, and no notice was taken of the softness or ductility of the metal combined with great strength. I know a case in which a sheet had to be selected of higher tensile strength than could be obtained at the time, coupled with much ductility, to repair a boiler so that it would pass the inspectors under United States laws. A lower ultimate tensile strength with high ductility would have made a safer job of the repair. We have come to the time now, when to hold our place in the world in competition with others, we should waste as little of our energies as possible in cutting and trying in any hap-hazard way and endeavor to avail ourselves of the acquired knowledge of the world generally, and make scientific application of the knowledge in our daily work.

"Midget locomotives" for plantation use are said to be superseding mules. One of them weighs only 3 tons, and they are used on rails which weigh 12 pounds to the yard. The cylinders are only 10 inches long. These little engines are not confined to wood for fuel. As lumbermen, they burn wood. As plantation engines, they frequently burn refuse sugar-cane. In a different form, but with the same diminutive cylinders, they are used in coal mines for hauling cars, and burn either soft or hard coal or coke. In their smallest sizes they are only 10 feet long over all, 4½ feet high and 5 feet wide. A few bushels of coal and a few pails of water keep them running all day. One of these mules in a coal mine at Brookfield, Ohio, pulls 20 cars, weighing nearly three-quarters of a ton each, up a grade 1,360 yards long that rises at the rate of 105 feet to the mile.—*Railway Age.*

A sewing-machine agent, who was very ill, being told that he must pay the debt of nature, wanted to know if he couldn't do it on the installment plan.—*Sewing Machine News.*

The exhibitors who drew medals at the New Orleans Exposition are informed that they can get them by sending $80 for the gold, and $8 for silver medals. By a liberal arrangement, those who did not win medals can, upon application, secure them upon the same terms.—*Brenham Banner.*

From the list of patents recently issued to Michigan inventors, we learn that a fiend in human shape has constructed a machine for pounding beefsteak, so that boading-house keepers can take the juice all out of the meat and make a pound of steak cover two square feet instead of one. The inventor and his patrons ought to be put into the machine.—*Battle Creek Moon.*

The new Exposition, at New Orleans, opened Nov. 10, under favorable auspices. The goods to be shown were not all in place, but a good representation is ready, and more exhibits are to follow. Financially the Exposition is in a better condition than the one of last year.

Steel rails have been selling in Chicago at $36, the highest price reached for many months. The prices of railroad securities have been pushed up in Wall street, and there is a good prospect of the building, of considerable new railroads in the near future. There are many short roads needed in the South and West for which the capital can be raised. There are also several roads partly completed which will be finished. It is unlikely that railroad materials will be any cheaper.

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The Tariff to be Assailed.

As the time draws near when a new Congress is to meet, the intentions of free-traders and so-called revenue reformers, to make a concerted movement for a cutting away of as much of our protective tariff as possible, are freely given to the public. Notwithstanding the fact that the new Congress, which meets the first Monday in December, is more favorable to protection than the one that dissolved last March, after defeating the Morrison bill, the enthusiasts who are fighting the tariff expect, by hook or crook, to force the passage of a bill making substantial reduction on a large part of the present duties. It does not appear that they expect a majority of the House of Representatives to favor such reductions, because the members themselves believe a cutting down of the tariff is beneficial to the industries of the country, but rather because of political party pressure. The party caucus has not heretofore been able to overcome the convictions of members who were opposed to a ruinous reduction of the tariff, and persuade them to act against the known interests of their constituents.

In our issue of February 21, we published letters from nearly a hundred of the 138 new members of the present Congress, who were not in the last Congress, defining their position on the question of protection. Taking those expressions in connection with the votes of re-elected members on the Morrison bill, we were enabled to figure out a clear majority for protection, or, at least, a majority opposed to reduction, with the motto "For revenue only" as the guide. The letters were written in answer to our questions, and they have the signatures of the members replying. We have carefully filed them away for reference during the coming session. Unless several members act contrary to their public declaration, no general or substantial reduction of the tariff can be effected by the Forty-ninth Congress. It is evident from a perusal of the letters we published last February, that there is a large majority of members in favor of some modification of the tariff, but there is a wide disagreement as to what articles shall be affected. It is possible that the tariff on sugar may be reduced, but who shall say upon what other articles an agreement for a reduction can be reached?

The agitation of the free-trade question in Congress is always calculated to injure business. Fortunately, the danger of a disastrous tariff reduction is small, in spite of the noise made by "revenue reformers."

Attracting and Repelling Manufacturers.

The present efforts of towns and cities in all parts of the country to secure the location of manufactories and railroad shops, is in curious contrast to the efforts not unfrequently put forth in the opposite direction twenty-five or thirty years ago. In one instance it was proposed to establish repair and car shops for a railroad just built, in a small town on the line, but the opposition was so strong that the idea was abandoned by the railroad officials. That town is in just about the same condition now that it was then, so far as progress is concerned. But the old spirit of exclusiveness has departed, and the citizens are loud spoken in acknowledging the mistake made in discouraging the building of the shops and consequent large increase of population. The shops were built in another small town a few miles away, and the growth in population and wealth has been constant since.

Another instance is that of a town whose name was suggestive of manufacturing, notwithstanding there was no manufacturing carried on there. The very name was so displeasing to the inhabitants, that they strongly discussed the propriety of taking steps to have it changed. That town remained the insignificant hamlet that it was until within a few years, a new and wiser generation have made successful efforts to introduce manufacturing, for which there were natural advantages. We do not hear now that the people are ashamed of the name of their town. There may be locations at this time where the inhabitants would discourage manufacturing, but we do not hear of any.

Rough on Railroads.

A press dispatch, referring to some trouble in a Western town, says: "The rough element outnumbers the law-abiding element two to one, as is the case in most railroad towns." It is truly astonishing what educators press dispatches have come to be. Most people have believed that railroads do an important work in civilizing a country; in eradicating the rough element of hitherto rather wild parts of the country through which they pass. But who shall dispute the wisdom of the average press dispatch?

Throw Out Wasteful Tools.

During the past few years the quality of machine tools has been greatly improved, and progressive shops have taken advantage of these improvements by getting rid of old tools and putting new ones in their places. Many times competition makes this an absolute necessity. But who ever hears of these old tools going into the cupola and scrap heap? They are all doing duty somewhere, and some one must pay for the work done on them. The men who operate them must get less pay, their owners must make less money, or customers must pay too much for their work. A little experience of a few years ago leads us to believe that sometimes at least the customer does the paying. It was in the instance of two machines, both of which went away from the shop at about the same time to places a few miles apart. Upon getting them at work it was found necessary to make the same change in each. The work to be done, in making the change, was not extensive, and in each instance was taken to the best shop in the vicinity. At both shops good men were put at work on the job, and worked faithfully. In one shop the tools were first class; the total time charged to the job was forty-two hours. In the other shop the tools were of a kind to suggest that they had been bought second-hand from some live shop about twenty years before. Here the time was seventy-one hours. There was nothing but actual time worked charged in either case.

The moral—if there is one—is that it would be better for everybody if some of the ancient machine tools, that may be seen in use in various parts of the country, could go through the cupola and blacksmith shop.

Introducing New Machinery.

There are some useful machine-shop tools that will sell only in certain sections of the country. In spite of persistent efforts, the manufacturers have failed to get up a demand in other sections. Some time ago a Western machine-shop owner designed and put prominently upon the market a very useful tool for any shop; but, as he informed us, after establishing quite a demand, all his orders came from the East. It is a well-known fact that certain desirable tools sell only in the locality where made, because their manufacturers never put forth any effort to sell them outside of their immediate neighborhood. The reason for the successful sale of good tools in certain sections, and their rejection in other sections, when equal efforts have been made to sell them everywhere, is not very apparent. Another peculiarity in demand that puzzles the mechanical philosophers is that there are times when it seems almost impossible to introduce certain kinds of new labor-saving tools, which, after a time, will be in lively demand. Not many years ago, centering machines and cutting-off machines were considered superfluities. They were put upon the market, but would not sell. Two or three years later they sold largely, and are now in use almost everywhere. The originator of a good tool or machine often gets discouraged because nobody seems to want his production when first trying to sell it. Sometimes he gives up in disgust, and tries things that are in certain demand, but with keen competition. The man who originates something of assured mechanical value, and is so determined to introduce it that a few months of ill success will not cool his ardor, will generally accomplish what he undertakes. It requires much patience and perseverance to introduce machinery of a new kind, but the reward is likely to be proportionate to the efforts.

Will some one tell us who makes flexible tubing that will stand hydraulic pressure of 2,000 to 5,000 pounds per square inch?

Industrial Exhibitions this Year.

On the whole, we think it must be admitted that exhibitions in which machinery is a prominent feature have not been eminently successful this year. There has not and is not as much interest in them as usual. It can hardly be said that the reason for this is hidden. In such exhibitions machinery forms a part only of the exhibits, and it is made secondary to something else in the way of position accorded and general accommodations. At least this is the expressed opinion of many exhibitors, and until this is changed they are not likely to be forward in going to the expense of preparing and placing exhibits of machinery. It is coming with them to be more and more a question of whether it pays to exhibit machinery at fairs under the conditions at present imposed.

Now that cut nails, made of iron, are finding their market disputed by cut nails made of steel, with probability that this tendency will steadily increase as steel nails and their merits become better known, it is interesting to look back to the early days when cut nails first began to dispute the market with the hand-made variety. Credit for making the first cut nails is claimed as far back as some years prior to 1790, for the firm then known as J. G. Pierson & Bro., doing business on the spot now known as No. 24 Broadway, New York City. The firm consisted of Josiah G. and Jeremiah H. Pierson, respectively grandfather and granduncle of Henry L Pierson, Jr., now senior member of the iron firm of Pierson & Co., located at 24 West street, New York, which firm only removed from No. 24 Broadway a year or so ago. In the year 1790 J. G. Pierson & Bro. removed their cut-nail works to Ramapo, N. Y., just over the Jersey line, where they carried on the business upon a large scale until about the year 1830.

A correspondent would like to know who makes a specialty of castings for false valve seats for locomotives.

The notorious Ferdinand Ward, the "Napoleon of Finance," has been sent to Sing Sing for ten years. He has been assigned to work for Perry & Co., cleaning castings and setting up stoves, for which the State will receive 56 cents a day. Ward's peculiar talent for figuring out "profits" ought to give him a position in the accounting department of that prison. Last year the managers of Sing Sing Prison figured out a net profit of $63,214 22, but the State Comptroller who receives and pays out all the money for prisons could not cipher up more than $33,531.82 profit. It has been given out that the profits of Sing Sing Prison are greater this year than last year. If the managers want to make a striking exhibit of profits they should, by all means, have Ward assist in preparing the report.

Locomotive engineers are almost, if not altogether, as superstitious in regard to haunted locomotives as sailors are in regard to haunted ships.—*New York Tribune.*

Locomotive engineers are about as common-sense and free from superstition as any class of men to be found. When they deal out to the enterprising news gatherer a little

romance about haunted locomotives and ghostly interference in train running, these astute individuals take the utterances in sober earnest. Nine-tenths of these shadowy stories which the daily press bring out about twice a year are the veriest kind of "old chestnuts," revamped for the occasion by some engineer of a little talent for that sort of thing and a big capacity for enjoying the results. Locomotive engineering is young and there has not, as yet, been time to get up more than about a half-dozen authentic ghost stories; engineers deserve considerable credit for working them over to meet the requirements of the press.

In a paper read before the American Society of Civil Engineers, by E. B. Dorsey, entitled "English and American Railroads Compared," he says:

"After careful inquiry, the average daily wages of the English engine-driver has been taken at 6s. 8d. = $1.60, and the American at $3.60, and that of the English fireman at 3s. 9d. = $0.90, and the American at $1 90. To equalize these, the American wages should be reduced 54.5 per cent., but in order to be safe, they have only been reduced 50 per cent.

The reduction spoken of is for the purpose of making comparisons of railroad operations, but suppose the free-traders should carry out their plans to cut down the tariff to a strict revenue basis, thus making the equalizing of wages a necessity. How would American railroad engineers and firemen regard the change? The privilege of buying foreign-made goods at lower prices would be but a small offset to such a sweeping reduction of wages. The free-traders are striving to bring about the equalizing process, but American workmen and manufacturers are determined that they shall not succeed.

Literary Notes.

The November number of the *National Car Builder* is one of the most valuable and interesting ever issued. Amongst the array of practical matter we notice an article by Angus Sinclair on "Combustion in Locomotive Fire-Boxes," which will not suffer by comparison with anything ever written on this subject.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(325) **J. C., Philadelphia, Pa., will find** the information he asks for on safety-valve calculations in the AMERICAN MACHINIST of December 6, 1884.

(326) **W. D. R., Minonk, Ill., will find** the information he asks for in four articles on "Laying Out Link Motion," by J. G. A. Meyer, in the AMERICAN MACHINIST of May 10, 17, 24, and 31, 1884.

(327) **F. H., ——, asks: What should** be the size of ports and steam and exhaust pipe for an engine 6″×6″, running at 600 revolutions? *A.*—Steam port, if fully opened, 9-16″×6″; steam pipe, 2″; exhaust pipe, 2½″.

(328) **We have a half-dozen inquiries as** to the fastest schedule time on any railroad in the United States, also in the world. We have no means of knowing this. It is constantly being changed, and is always a matter of controversy.

(329) **C. O. W., Moravia, N Y., asks:** 1. What diameter of steel shaft will be required for a pearl barley stone weighing 5,000 lbs, running 350 revolutions per minute? *A.*—It would be impossible to tell without knowing all the conditions and arrangements. Why not be guided by the practice of others? 2. What should be the length of a journal for babbitt? *A.*—From 3 to 4 times the diameter, when practicable. 3. Is a stone more likely to burst from being out of balance providing the journals are rigid? *A.*—Yes. 4. If I make a friction-brake, which will give the greatest resistance, one 2″, or one 3″ long, the pressure being the same? *A.*—Under ordinary conditions, there will not be much difference.

(330) **J. H. G., Leadville, Col., asks:** What is the largest single-cylinder engine, and the largest high-pressure boiler? *A.*—The largest single-cylinder we recall at this time is that of the steamboat Pilgrim, 110 inches diameter and 14 feet stroke. We have no means of knowing the dimensions of the largest boiler.

(331) **A correspondent writes us that F.** S. (Question 320) should, to avoid the trouble he experiences, turn the smallest or neck diameter of his worm-gear 5.22 inches. This is correct, according to the plan of measuring the pitch diameter at the point of smallest diameter of gear. Thus, the circular pitch being 1-5″, the corresponding diametrical pitch is 3.1416 + 1-5 = 15.708. The number of teeth divided by this, 80 + 15.708 = 5.093, the pitch diameter in inches; 2 + 15 708 = 0.127 to be added; 5.093 + 0.127 = 5.22 inches, the total diameter.

(332) **F., Jersey City, N. J., asks:** 1. What per cent. of the combined opening through tubes should the area of smoke-stack for a vertical boiler be? *A.*—If the tubes are properly proportioned to grate area, make area of smoke-stack same as opening through tubes. 2 How is the draft affected if the stack is larger? *A.*—If very much too large the draft will not be quite so good, owing to the gases being cooled more. Within such limits as are likely to occur in practice, there will not be a noticeable difference. 3. If in balancing an engine the shaft, with fly-wheel and the connecting-rod, piston-rod and piston is put on knife-edges and weight enough put into rim of wheel to balance the whole, will it be in balance when running? *A.*—No. The probability is that it will be worse than with no counterbalance. Generally, the balance may be helped a little by weight in the fly-wheel, but to what extent, or what the weight should be when so used, can only be found experimentally. 4. If I make a steam-engine governor, the valve of which will have a movement of only about ⅛″, would it not necessitate using a very heavy fly-wheel? *A.*—Not necessarily. If the balls or weights move but a short distance to move the valve through its entire range, then it will be necessary to use a heavy fly-wheel and to have all parts of the governor finely constructed, so there shall be but little friction to disturb the action.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

T. M. Parker, Steel Stamps, Stencils, Hart'f'd, Ct.

J. Clayton, Air Compressors, Rock Drills. 43 Dey st, N Y

Edw. Sears, wood engraver, 48 Beekman st., N.Y.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Tack, Wire, and Shoe Nail Machinery; Wm. A. Sweetser, Brockton, Mass.

Roper's Engineers' Handy Book, $3 post paid. Theo. Audel & Co., Booksellers, 32 Liberty st., N.Y.

Steel shank, wire nail, shoe nail and tack machinery. Keith & Trufant, Campello, Mass.

Patents. Fees, $10 up. L. A. Hill & Co., 165 B'way, N.Y. Foreign patents ½ rates. "Hints" mailed free.

PRACTICAL PROGRESS.—Spec. copy free on receipt of business card. R. Grimshaw, 32 Liberty st., N.Y.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John st., N. Y.

Tack and Wire Nail Machinery, made by the Willets Mfg. Co., Providence, R. I.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor Fulton and Dutch sts., New York.

Patent attorney and expert. Machine designs and details. Wm. H. Weightman, 82 Astor House, N.Y.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Foot-Power Machinery for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Lyman's Gear Chart. How to lay out gear teet Price, 50c. E. Lyman, C. E., New Haven, Conn.

Six-spindle Gang Boring Machines, manufactured by Williams, White & Co., Moline, Ill.

Improved Labor-Saving Upright Drills. 20 in. to 36 in. inclusive. Currier & Snyder, Worcester, Mass.

Selden Packing for stuffing box, with or without rubber core Randolph Brandt, 38 Cortlandt st., N.Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Nov 7 p. 14. Send for circular No. 17, Curtis Reg Co., Boston, Mass.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co., Collinsville, Conn.

The outline ("wax process") engravings shown in the AM. MACHINIST each week are made by Struthers, Servoss & Co., 24 to 34 New Chambers St., N.Y.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-Taught;" $4. Books for workmen. Joshua Rose, Box 3306, New York City.

Locomotive Engine Running and Management. By Angus Sinclair. Gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air brake explained by aid of engravings. Price, $2. For sale by *National Car Builder*, 187 Dearborn st., Chicago, Ill.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies

Manufactures.

It is said that railroad repair shops are to be erected at Sanford, Fla.

A company is being formed at Huntington, W. Va., to build a nail mill.

A. & W. McQueen, Plainview, N. C., contemplate the erection of a cotton seed oil mill.

It is said that the Marshall and Northwestern R. R. Co., of Marshall, Texas, will erect repair shops at Paris.

The Sykes Chair Co. of Buffalo, N. Y., will erect a four-story chair factory on Bristol street, to cost $12,500.

Danvers, Mass., parties are preparing to erect a shoe factory 150x40 ft., and another 80x38 ft., each stories high.

Mr. Knowles, 86 Broad street, New York, will erect a one-story factory, 100x600 ft., on Van Dyke street, Brooklyn.

The Brooklyn Elevated Railroad Co. has commenced to erect its repair shops at Manhattan Beach Junction, East New York.

There is some probability that Pullman's Palace Car Co., will rebuild the shops destroyed by fire at 41st street and Girard avenue, Philadelphia.

Daniel T. Kelly, Portland, Me., is about to erect a three story wooden building, 85x40 ft., on Kennebec street, for an agricultural implement factory.

The Pond Engineering Co., of St. Louis, have closed a contract to furnish the pumping machinery for the El Dorado, Kansas, water-works.

Somersworth Machine Co. are putting in the foundation for their foundry at Dover, N. H., 200x60 ft., and will remove from Great Falls as soon as their building is ready.

The Whittier Machine Co., of Boston, have purchased the old shops of the Boston Machine Co., and will carry on the same business as heretofore conducted in those shops.

The Oliver Oil Co., which has cotton seed crushing mills at Charlotte, N. C., and Columbia, S. C., will build a refinery at the latter place. The capacity will be about 150 barrels per day.

The Safety Steam Generator Co., 68 Warren st., New York, write us: "We are now having a boom in the sale of the Zell boiler, and have decided to build large works for its manufacture.

Osse & Thomas, 37 N. Calvert street, Baltimore, Md., make a specialty of producing large blue prints to order, for which they have a regular price-list. Specimens we have seen are good.

It is reported that the Baltimore & Ohio Railroad Company will erect large machine shops and round-house in Wheeling, W. Va., next spring, and the building materials will be gotten ready this winter

J. C. Peck, of Atlanta, Ga., contemplates the erection, in the near future, of a planing mill 42x100 ft. on the ground, and two stories in height; the estimated cost of building and equipment is placed at $5,000.

H. L. Horne is building a new mill at Steep Falls, Maine, on the Saco, on the site of the old one recently removed. It will be two stories high, and is to be occupied by George W. Holmes as a wood-working and fitting shop.

Megquier & Jones, Portland, Me., will build a new foundry this fall at the corner of Pearl street and Ashland Avenue, running back to Vine street. The building will be about 75 feet square, and three stories.—*Industrial Journal.*

Wilson, Walker & Co., Limited, Pittsburgh, Pa., have bought several acres of ground adjoining their Lucy furnace property. There are rumors of a reorganization of the company and the erection of extensive works on this land, including a Bessemer plant.

Williams, White & Co., Moline, Ill. have sent out a new illustrated catalogue of special machinery manufactured by them. It includes iron bending machines, drop-hammers, gang-boring machines, upright drill presses, skein-setters, and power-punches and shears.

M. H. Ould, Perrymans, Md., and J. F. Towner, of Baltimore, have formed the Standard Fence Co. at Perrymans, Md., to manufacture machines for making fences. J. H. Emmord will be manager. Part of the machinery has been purchased.—*Baltimore Manufacturers' Record.*

Dean Bros. Steam Pump Works, Indianapolis, Ind., issue a neat illustrated catalogue of distillery pumps. It gives a long list of distilleries and breweries in different parts of the country using Dean pumps which must be perfectly appalling to strict prohibitionists, as some of them have over twenty pumps in use.

The casting of the big 54-ton gun at the South Boston iron works was a failure. The men, upon stripping the mould from the gun, found that, owing to the unequal cooling, caused by the core having given way on one side during the process of casting, it had cracked open, destroying the gun, which will have to be re-cast. The core arbor will either be repaired or a new one made. This will cause great loss.

The Marshall (Mich.) *Statesman* says: "A move is on foot to organize a stock company and build a fine, large paper mill somewhere west of the present mill. The latter is in a dangerous condition, the walls being unsafe, and as the lease soon expires, it is thought best to put up another structure with a capacity four times as great. The project is regarded with much favor by our local capitalists, as the showing made during the years in which this mill has been in operation is a fine one.

The Otto Gas-Engine Works, Schleicher, Schumm & Co., Philadelphia, have issued a circular relating entirely to engines of 15 H. P., or larger. Originally the Otto gas-engines were made in sizes from one to six horse-power only. The steady decrease in the price of gas during the last few years, and the success of the engines of smaller power, have given rise to a demand for much larger-sized engines than could be run with economy at the old rates of gas. The new sizes of gas engines are unusual.

The Valley Flour Mill is directly opposite the railroad depot at Brattleboro, Vt. Neatly framed and conspicuously displayed on the wall of the engine-room is the following legend: "This is a Westinghouse automatic engine; it is making 375 revolutions a minute; it is 35 horse-power; the engineer is deaf and dumb. For further information inquire at office." It is said that the Ananias who runs that engine enjoys the expressions of pity thrown away upon him by the strangers who pass that way.

The Columbus (O.) Buggy Co. are putting up a new boiler-house, as well as making other additions. Some 250 H. P of Babcock & Wilcox boiler, a 12″x38″ Brown engine, and another engine for electric lighting of about 60 H. P., will be added. A number of new machine tools will be added, such as lathes, planers, and drill presses. They have a capacity of making 75 complete first-class buggies every day, being the largest establishment of this kind in the world. Mr. O. A. Lamphear, who recently gave us a call, is foreman of the machine shop.

The Westinghouse Machine Co. are still further enlarging and improving their works. They are building a furnace to be fired with natural gas, and are erecting a steam hammer for the die-forging of their connecting-rods from mild steel. They are also building a brass foundry for the production of their own castings. Natural gas has been introduced throughout the works. Within a month Westinghouse engines have been ordered from Buenos Ayres, Haut Saone, France; Havana, Cuba; Rotterdam and Leyden, Holland, the latter being for the Government Physical Laboratory.

The Stiles & Parker Press Co., Middletown, Conn., and 59 Duane street, New York, have issued a new illustrated catalogue of over 100 pages, showing the line of presses, dies, drop-hammers and special machinery made by them. In the preface they say it is impracticable to represent but a small number of the machines for which they have patterns. They have been in the business for nearly thirty years, and their machines and tools are in use in the Government as well as private armories in Austria, Egypt, Prussia, Russia, Turkey, Sweden, and the United States and Mexico, and by the principal manufacturers of the country. New machines are being constantly added.

Work was begun at Roach's shipyard in Chester, Pa., Monday morning, Nov. 9. The three cruisers, Boston, Chicago, and Atlanta, will be completed as soon as practicable. The work commenced with 250 hands, and probably the number will be increased to 400 within a short time. The yard will be operated by the Government, the men paid navy-yard prices, and work navy-yard time, eight hours per day. It is understood that the shipyard will be, after the cruisers are completed, under the direction of the Mallory Steamship Co., of which Mr. John Roach is president. From present indications, it is probable that considerable work will be done at the Chester yard in the immediate future. The monitor Terror has had her compartment pipes placed in position, and she can be finished in a short time, if occasion damands. The work on the cruisers is to be done by the Government, although it will be under Messrs. Roach that men are hired and work. Still a Government agent has charge, and work will doubtless be done in "navy-yard style."

The New York *World* has an article about the retirement of silk manufacturers from Paterson, N. J. It says: "Among the leading manufacturers of the city are John Ryle, Pelgram & Meyer, Dexter, Lambert & Co., Standard Silk Company, and John C. Ryle & Co. Of these, Messrs. Pelgram & Meyer have established a factory in Boonton, N. J.; John C. Ryle & Co., are openly rumored as being about to transfer their entire business to Stroudsburg, Pa.; Chas. E. Meding has determined upon locating in Mauch Chunk, Pa., and the Standard Silk Company have fixed upon Phillipsburg, N.J. as their future base of operations. But these rumors are entirely eclipsed by the announcement that John Ryle, popularly known as Honest John Ryle, the "father" of the silk industry of Paterson, and who has spent thousands of dollars and 45 years of his time in maturing the business, has made arrangements to move a large portion of his machinery to Allentown, Pa., and that but a short time will elapse before the entire establishment will be known no more in Paterson." It seems that other towns have offered extraordinary inducements for Paterson silk manufacturers to locate within their borders.

A. B. Sutton, Stillwater, Me., will at once rebuild his saw-mill recently destroyed by fire.

E. Knapp will build a flouring mill at Greenleaf, Kansas, the citizens having furnished the ground.

The spool factory of Golder Bros., recently burned at Belgrade, Me., will be rebuilt by H. W. Golder, of the old firm.

Weston & Smith, Syracuse, N. Y., have just finished a machine for grinding and polishing the edges of stove tops and similar work. Four wheels are used, operating on four pieces at once.

Machinists' Supplies and Iron.

NEW YORK, Nov. 12, 1885.

The condition of the supply business and manufacturing are substantially unchanged since our last reports. Prices have not materially changed; material change in prices is not probable so long as the possibilities of manufacturing are greater than the demand.

Iron—In American pig transactions are in small lots, but are numerous enough to encourage the holding of prices firm. The situation is such as to encourage furnacemen. We quote No. 1 X Foundry, standard brands, $18 to $18 50; No. 2 X Foundry, $16 to $16 50; Grey Forge, $14.50 to $15.50.

Scotch Pig—These brands are in little demand. Coltness has sold at $19.50 to $20; Glengarnock, $18 50 to $19; Gartsherrie, $19 to $19.50; Summerlee, $19 to $19.50; Eglinton, $17.50 to $18; Langloan, $19.50; Dalmellington, $18 to $18.25.

Lead—Car lots have sold at 4.15c. to 4.20c., but the demand is light.

Copper—Sales are slow. We quote Lake 10.90c. to 11c., other brands, 10c. to 10¼c. Buyers are generally able to obtain some concessions from these figures.

Tin—Prices have ruled a little lower, but the demand has not improved. Jobbing lots of Banca have sold at 20½c.; Straits and Malacca, 20.30c.

Spelter—Refined, 5¾c. to 6c.

Antimony—Hallett's, 8½c.; Cookson's, 9½c., with slight concessions to buyers.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Situation as foreman of machine shop; good references given. Address Buckeye, AM. MACHINIST.

Wanted—Situation as tool-dresser, by a first-class workman. Address Durability, Box 126, Utica, N. Y.

A first-class machinist desires situation; prefer to go South. Address J. W., P. O. Box 64, Pittsfield, Mass.

Position wanted as draftsman, bookkeeper, or cost clerk, by young man, in machine shop or factory. W. D., AM. MACHINIST.

Wanted—First-class lathe hand on small and medium work; good pay and steady work guaranteed. Address Baltimore, AM. MACHINIST.

Situation by foreman machinist on agricultural implements or machinery; well acquainted with improved methods of getting out work cheaply. Address B. B., AM. MACHINIST.

Wanted—By practical mechanic, designer and draftsman, position as supt. or foreman of machine works; have had large experience handling men and systematizing work; best reference given; corresp'ce solicited. Address Box 486, Waterbury, Ct.

MISCELLANEOUS WANTS

Advertisements will be inserted under this head at 35 cents per line, each insertion.

The Crescent Steel Tube Scraper is king. Crescent Mfg. Co. Cleveland, Ohio.

Wanted—Patented articles to manufacture and introduce. Box 88, Newark, N. J.

Roper's Care and Management of Steam Boiler, $2 postpaid. Theo. Audel & Co., 32 Liberty st., N. Y.

To make room for larger tool, will sell cheap, for cash, a planer 42"x42"x12', in good order. Address, P. O. Box 2085, Bridgeport, Conn.

Light machinery of all kinds built at short notice. Good workmanship guaranteed. Pennington & Mills, 8 Dey st., Jersey City Heights, N. J.

Wanted—A good second-hand 60" lathe, to take 16' between centers. Address, with particulars, A. B. Bowman, 1101 N. 2d st., St. Louis, Mo.

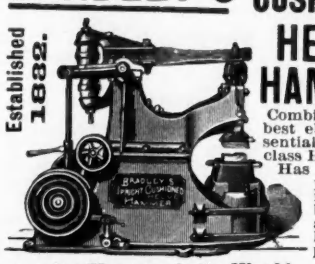
Special mch's. for any kind of mfg. designed to order. Also plain and autom'c eng's. Send for circular and refs. Weston & Smith, Syracuse, N. Y.

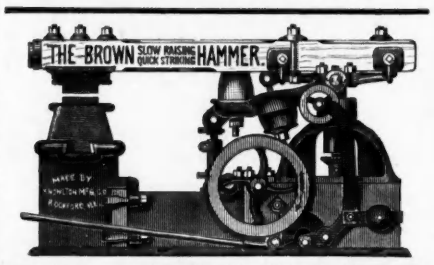
Gun Machinery—For sale, a shop containing a full equipment of machine and special tools, patterns and patents required for making a well-introduced shot-gun. For particulars, address S. O Randall, 70 Weybosset st., Providence, R. I.

FOR SALE AT A BARGAIN,
MACHINE SHOP AND FOUNDRY,
With buildings, lots, machinery, stock, &c., in a town of 6,000 to 8,000, having three trunk line railroads. Will sell on easy terms. Address,
YOUNG & CO., KOKOMO, IND.

MORRISON'S PRACTICAL ENGINEER,
A Complete Treatise on Steam and Gen'l Machinery.
MAILED ON RECEIPT OF $1.
Indicators, Engineers' Instruments and Outfits.
W. A. MORRISON, Box 373, *Lowell, Mass*

CHANDLER & FARQUHAR,
GEARS 177 & 179 Washington Street, BOSTON, MASS.
Of all kinds in Stock and Made to Order.
Estimates Furnished for Model or Light Machine Work.
Tools and Supplies for Machinist and Manufacturers.
Send for Catalogue B.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER
Established 1832.

Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**
BRADLEY & CO. Syracuse, N.Y.



THE BROWN HAMMER
STRIKES A BLOW WITH
DOUBLE THE VELOCITY That it Raises the Hammer.
A NEW MOVEMENT! SEND FOR DESCRIPTION.
KNOWLTON MFG. CO., King St., Rockford, Ill

STEPHENS VISES PATENT

50 Per Cent. of time and labor saved by using this solid, strong, durable, quick-working Vise. Has the improved taper, pipe and other attachments. Sold by the trade. Send for circular.
MELVIN STEPHENS, Prop'r, Office, 41 Dey St., New York.

BEAUDRY'S
UPRIGHT HAMMER
Has no Shaky WOODEN HELVE.
Springs of Best Rubber.
BLOW, TRUE AND ELASTIC.
Most practical and economical hammer made.
Will reduce expenses of any shop. Send for description.
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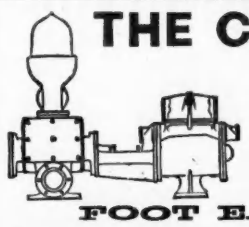
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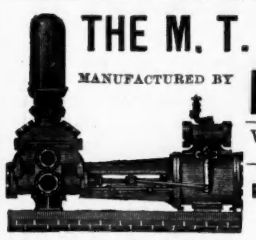
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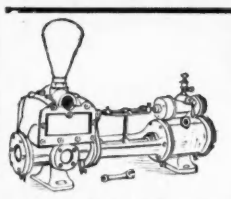
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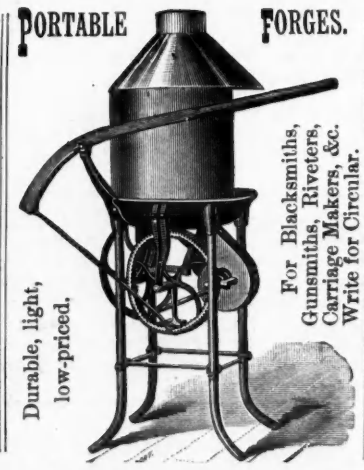
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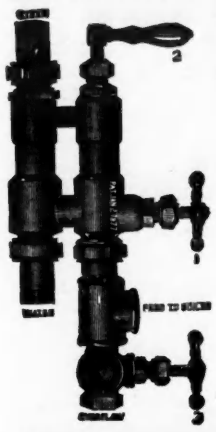

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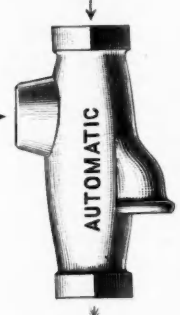

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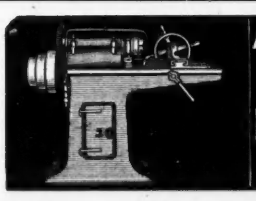

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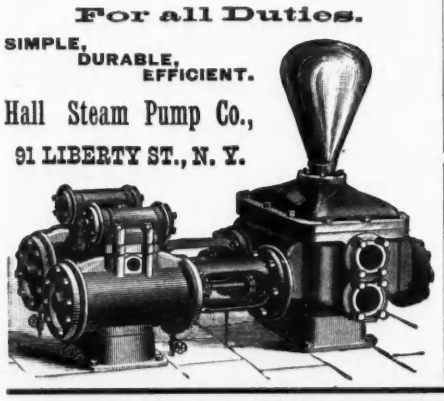

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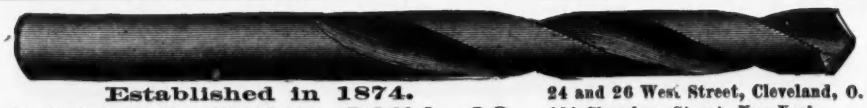

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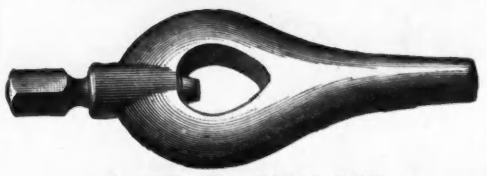

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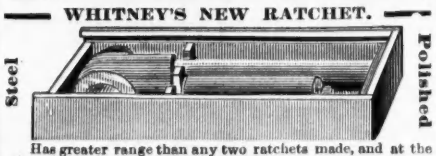

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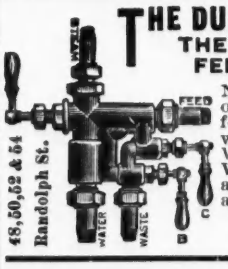

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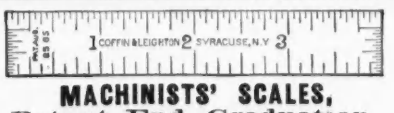

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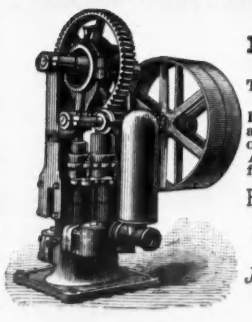

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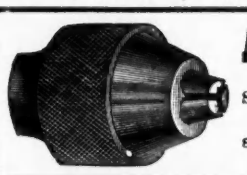

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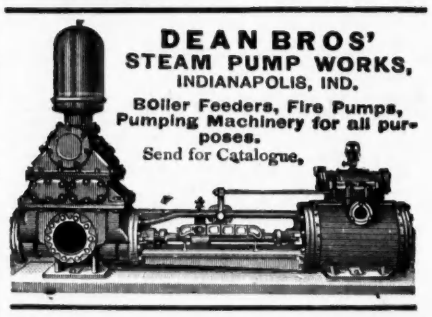

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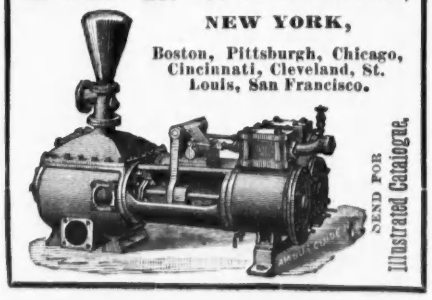

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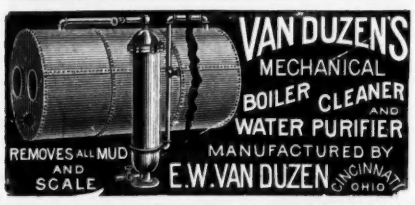

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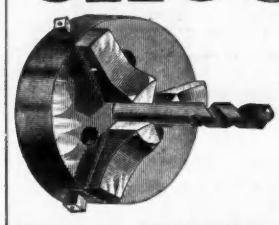

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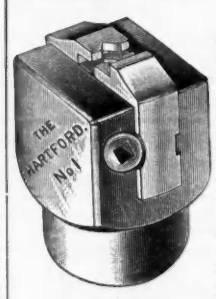

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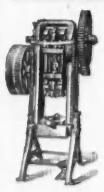

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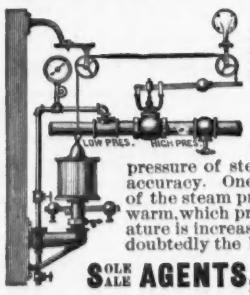

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NOTICE.

Week before last we published, under this heading, references to a small portion of the practical articles that have been specially prepared for the AMERICAN MACHINIST, and have appeared in our columns during the last few months. Last week we published an additional list. We append another list below. No other mechanical journal in this country has or ever has had such a collection of practical articles, by writers of well known ability, as are presented in these columns week by week. Every issue gives information that is taken up and applied in the shops and factories in various parts of the country. Copies containing these articles can be readily obtained by ordering of any newsdealer, or by writing to this office, at 5 cents per copy.

Wm. M. Barr.

Kaolin and Plaster of Paris as a Boiler Covering May 17, 1884
Another Explosion in a Pump Plunger. May 31 1884

Frank H. Ball.

Balancing the Reciprocating Parts of Steam Engines January 3, and February 21, 1885.

Frank H. Richards.

Something About Chucks. January 12, 1884
Running a Lathe. January 12; February 23; March 1; May 3, 17, 1884
Grinding and Using Cutting Tools. May 2, 1885
Grinding Tools Again. June 6, 1885
Screw Cutting on the Engine Lathe. June 13, 1885
Pay Days and Early Closing. August 15, 1885.
Twist Drills and Twisted Arithmetic. July 25, 1885.

George Escol Sellers.

Early Engineering Reminiscences. June 7, 14; July 12; August 9, 23; October 11, 25; November 1; December 13, 20, 1884. February 28 March 14; April 11, August 22, 1885

John W. Nystrom.

Inertia Diagram. Dec. 27, 1884
Inertia. Aug. 30, 1884

George Marshall.

The Result of Imperfect Setting of Horizontal Tubular Boilers. May 24, 1884.
Form and Material of Boilers. June 14, 1884
Agricultural Boilers. September 27, 1884
Boiler Chimneys Considered from an Economical Standpoint. August 16, 1884
Boiler Domes. Flanging. May 3, 1884
Braces and Boilers. May 17, 1884
Points in Boiler Construction. August 9, 1884
Thoughts and Hints on Boiler Construction. July 26, 1884
Boiler Fittings, Boiler Tests and Inspection. Feb. 16, 1884
Boiler Plate Stamps, Laminated Plates and Steel Plates. April 26, 1884
Use of Mild Steel in Boiler Construction. March 8, 15, 1884
Safe and Unsafe Methods of Boiler-Making. Jan 12, 1884
Boiler Braces. May 3, 1884
Boiler Repairing. May 10, 1884
Objections to Boilers of the Locomotive Type April 5, 1884
The Care of Boilers. January 26, 1884
English *versus* American Boilers. July 19, 1884
Laying Out Sheet Iron and Boiler Work. August 15, 1885.

Fred. J. Miller.

Universal and Combination Lathe Chucks. May 24, 1884
Making Cutters for Involute Gear Teeth. February 16, 1884
Milling Machines, Tools and Fixtures. September 20, 1884
Pitch of Milling Cutter Teeth. October 4, 1884

L. C. Jewett.

Draft and Finish of Patterns. May 31, 1884.
Making 18" Face Pulley from a 12' Pattern. November 15, 1884

Thos. D. West.

Sound Castings. December 6, 1884
Small Castings. March 15 1884
Momentum and Rules for Weighting Down Copes. August 2, and July 26, 1884
Green Sand Cores. January 12, 1884
Foundry Cranes. August 23, 30, and September 6, 1884
Oddity and Science in the Construction of Cupolas . May 10, 1884
Small Cupolas. January 19, 1884
Cylinder Moulding. March 22, 1884
Sweeping Grooved Cone Drums. April 19, 1884
Elements and Manufacture of Foundry Facings. May 24, 31, 1884
Foundry Plant. June 28, 1884
Heavy and Light Work Skimming Gates. November 8, 1884
Intelligence in Melting. February 2, 1884
The Mould Board. March 15, 1884
Ovens and Pits. June 28, 1884
Pipe Patterns. January 12, 1884

Isaac Whitehead.

Construction Gear Patterns. May 24, 1884.
Construction of Patterns for Bevel Gears. June 21, 1884
Geometry Applied to Pattern Making. April 26, 1884
Pattern Making. March 24, 1884
Engine Pattern Work. April 19, 1884.
Material for Patterns. April 5, 1884
Construction of Circular Patterns. May 3, 1884
Allowance for Shrinkage and Finish in Patterns. June 28, 1884
Copying and Making Patterns From an Old Propeller Wheel. March 1884
How to Strike Up a Propeller Wheel. March 15, 1884

S. W. Goodyear.

Personal Recollections. January 12, February 9, March 15, 1884; July 18, 1885
Hardening and Tempering Steel. Dec 13, 1884
Hardening Pieces of Steel. January 3, 1885
Some Thoughts About Steel. February 28, 1885
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Cutting Tools. July 25, 1885.
What I Know About Jigs. August 1, 1885

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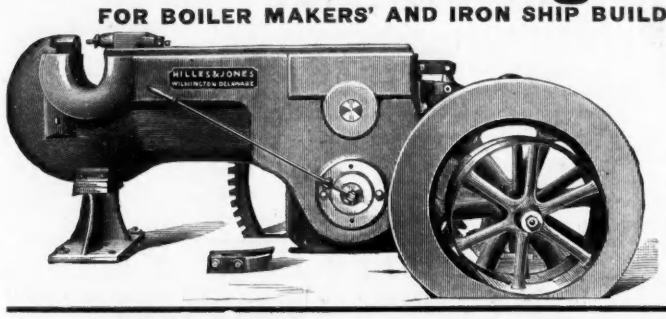

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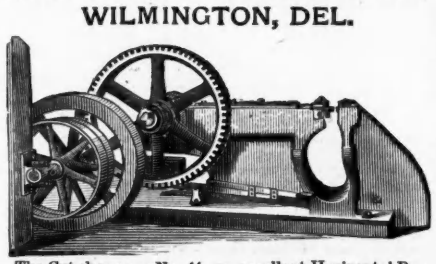

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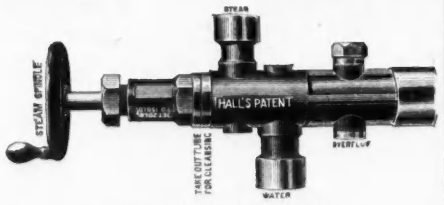

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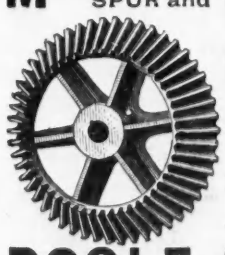

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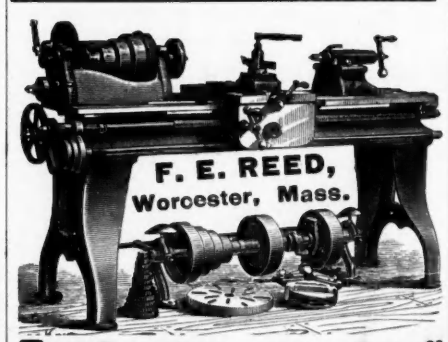

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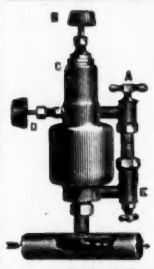

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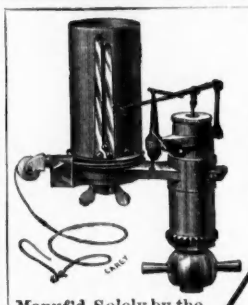

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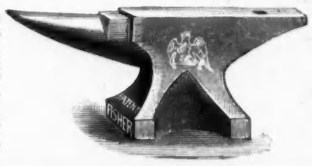

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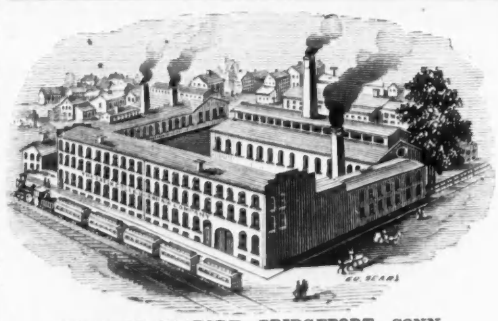

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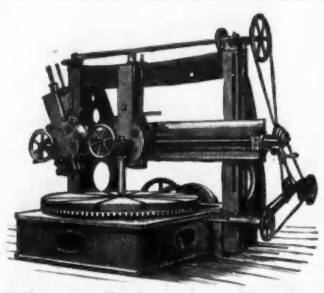

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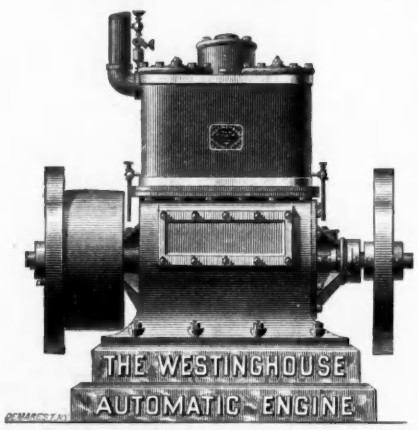

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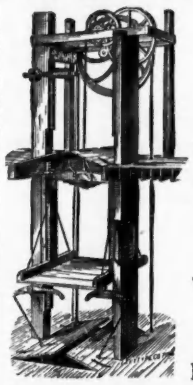

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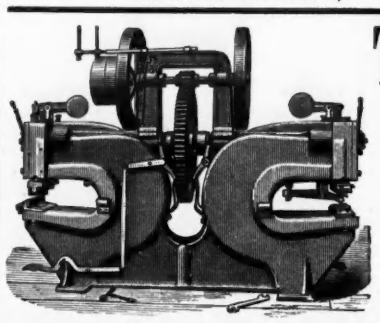

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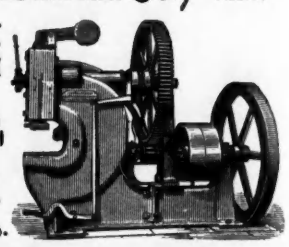

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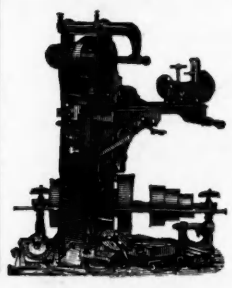

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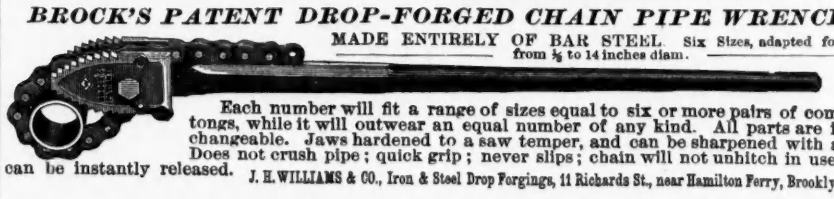

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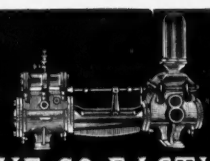

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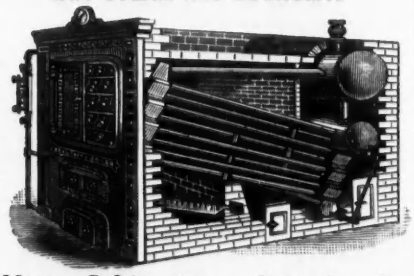

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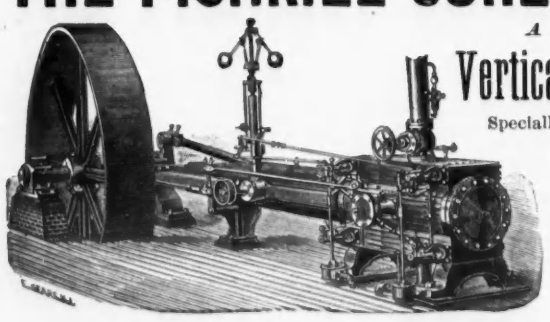

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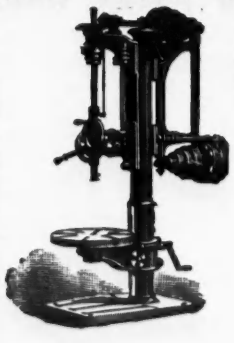

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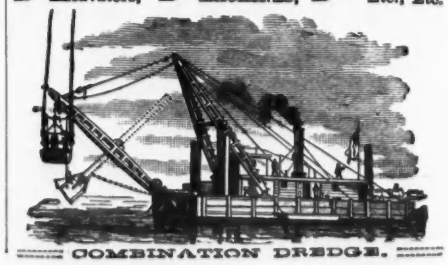

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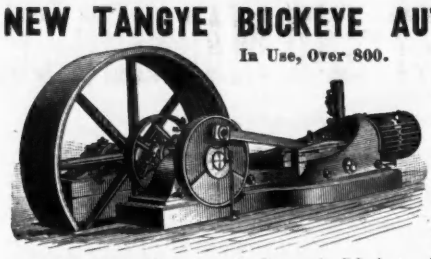

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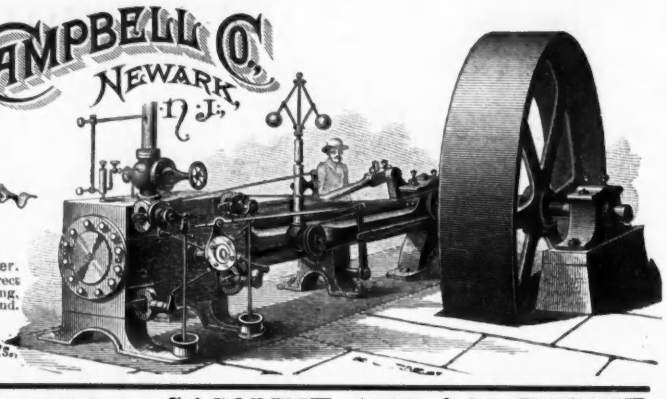

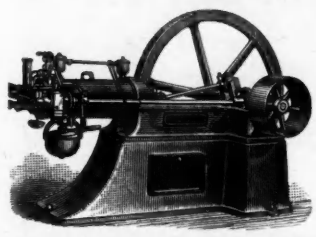

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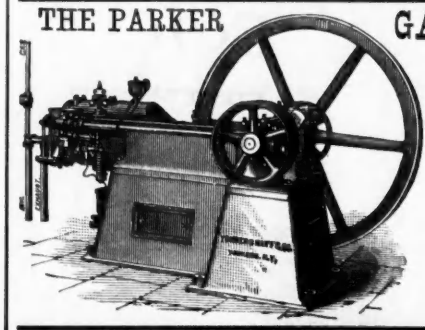

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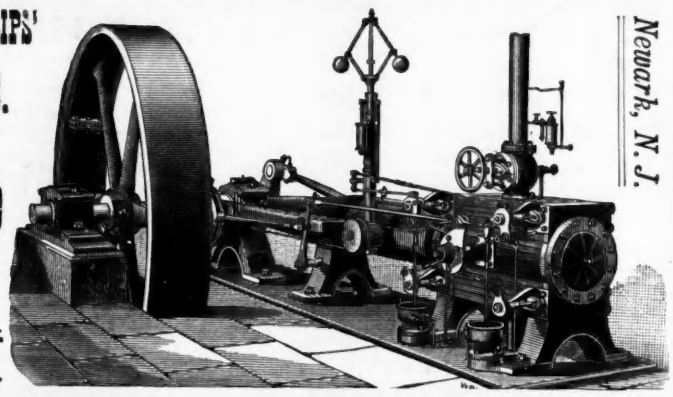

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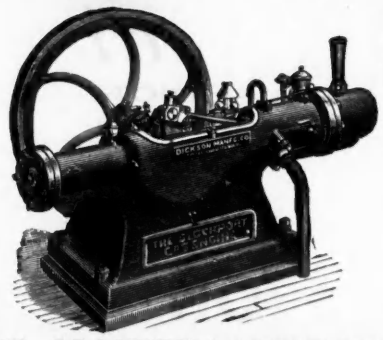

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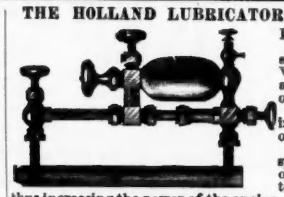

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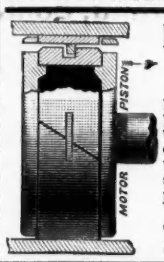

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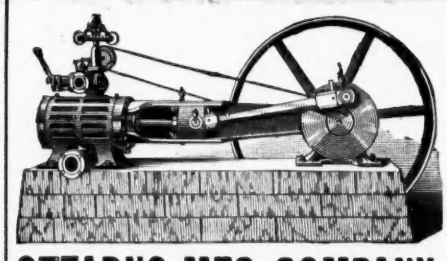

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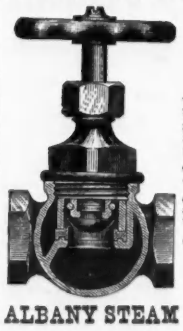

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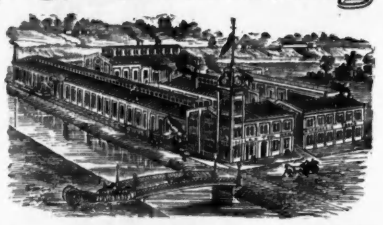

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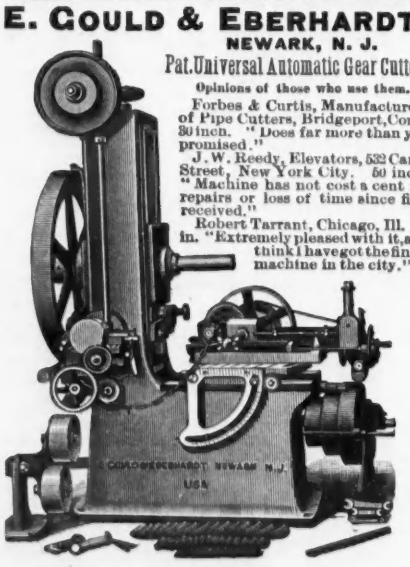

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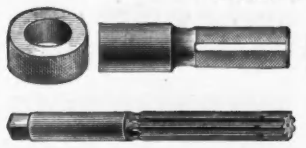

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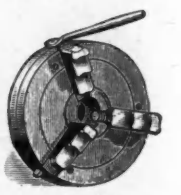

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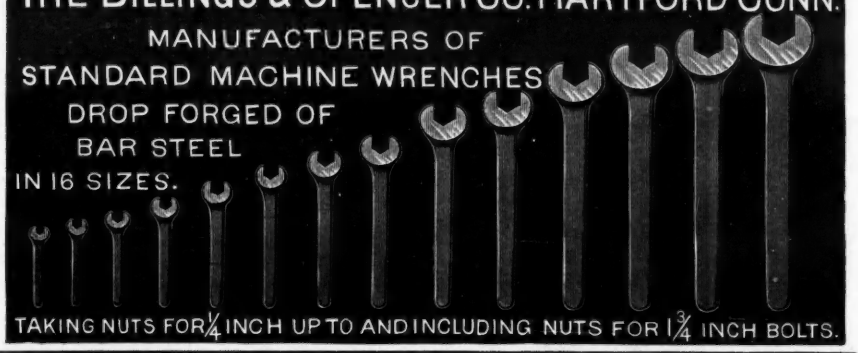
IN 16 SIZES.



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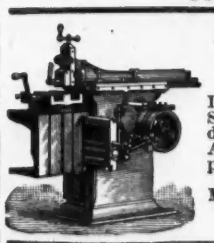

All the adjustments are made without operator moving from his position. It is made to act as a SLOTTING MACHINE, and is so arranged that KEY SEATS may be cut in any part of a shaft of any length, and from 4 inches in diameter down, and will plane a block 26"x26"x20". Has SWIVEL GRADUATED VISE, two changes of speed, and is geared 36 to 1. It is very heavy and powerful, and is guaranteed to give perfect satisfaction.

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